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AMERICAN JOURNAL OF PSYCHIATRY

Vol. 97

NOVEMBER, 1940

No. 3



UNDER THE AUSPICES OF
THE AMERICAN PSYCHIATRIC ASSOCIATION

PUBLISHED BI-MONTHLY

SUBSCRIPTION, \$6.00 A VOLUME

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THE DIRECT MEASUREMENT OF NERVOUS AND MUSCULAR STATES WITH THE INTEGRATING NEUROVOLTMETER (ACTION POTENTIAL-INTEGRATOR).*

By EDMUND JACOBSON, PH. D., M. D.,

Laboratory for Clinical Physiology, Chicago.

The predominance of conflicting views concerning the phenomena of nervousness and the neuroses as well as of the integrated normal conduct of man prompts the search for an instrument of precision which can conveniently open the way toward more accurate knowledge. If we are able to secure readily a graph of the amplitudes of action-potentials in a selected nerve or muscle tissue during a period of experimental or of clinical observation, a vast variety of problems in animals as well as in man can be investigated. I can now report the third and final step toward this accomplishment, resulting in an instrument which seems useful in office and hospital practice. It will be of interest first to review the previous two steps.

The subject lies or sits quietly, or performs some specific activity, while electrodes lead off the action-potentials from a selected region of nerves or muscles. Although surface electrodes can be used for many muscular regions, I have most often employed platinum-iridium wires which, in man, can be inserted into a muscle, such as the biceps, or into a nerve such as the ulnar.

In the technic first developed,^{1, 2} a string galvanometer and amplifier assembly are employed. The string tension is set at 3-4

* Read before the American Association for the Advancement of Science, Section I, Psychology, December 28, 1939. For a briefer report, see E. Jacobson, Variation of muscular tension (action-potentials) in man. *Am. J. Physiol.*, p. 388, May, 1940.

¹ E. Jacobson, Electrical measurements concerning muscular contraction (tonus) and the cultivation of relaxation in man. Studies on arm flexors. *Am. J. Physiol.*, 107: 1, 230-248, 1934.

² E. Jacobson, Measurement of the action-potentials in the peripheral nerves of man without anesthetic. *Proc. Soc. Exper. Biol. & Med.*, 30: 713-715, 1930.

millivolts per centimeter deflection, yielding a frequency response characteristic which is flat up to about 200-300 cycles; or the string is critically damped. The amplifier is transformer coupled with a characteristic flat between 20 or 30 to about 4,000 cycles. In the most recent refinement of this apparatus, an almost incredible voltage sensitivity combined with stability has been achieved. Under conditions when the string shows a response of 1.6 centimeters per microvolt a. c., the stability is such that when a short circuiting wire is connected across the input terminals of the amplifier, the string becomes practically quiet to the naked eye, for there is but a fraction of a millimeter of vibration.

Action-potentials recorded photographically on moving film in this manner present quantitative data concerning "nervousness" or muscle "tenseness" in a precise physiological sense. After suitable measurements and corrections, the mean peak voltage per unit of time can be determined. In graphic form, the results can then be submitted as the curve of action-potentials (expressed in mean peak microvoltage in the leads per unit interval) during a period of observation such as an hour or more.

This procedure is both expensive and time consuming. Careful photography is required. To save film or bromide paper, the camera is run for three seconds, then stopped for seventeen seconds, thus providing three samples per minute in place of a complete record. It seemed important to overcome these disadvantages.

Accordingly, in a second report (A.A.A.S., June 22, 1937), a new method was described for use in nerve or in muscle tissue in man and in animals which makes possible the instant reading of the potential differences in the electrodes. The action-potentials are rectified and the value in microvolts is read on a meter. In effect, the instrument serves to average the action-potentials at the moment and accordingly was called the Neurovoltmeter.³ So far as I know, rectification has not hitherto been employed in the registration of action-potentials.

The final step toward securing a record of the mean values of action-potentials covering a period of investigation, such as an hour or more, would be to integrate the above-mentioned average

³ E. Jacobson, The neurovoltmeter. *Am. J. Psychol.*, 52: 620-624, Oct., 1939.



FIG. 1.—The Integrating Neurovoltmeter (Ballistic Galvanometer Not Shown).

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values over a selected unit of time and divide the result by the time duration of the test. It seemed to me that this should be accomplished with sufficient accuracy by permitting the discharges from the amplifier to charge a condenser, under proper circuit conditions, measuring the accumulated charges thereon at appropriate intervals. To this end an instrument has been developed which can be appropriately called an action-potential integrator or an integrating neurovoltmeter. I am greatly indebted to the Bell Telephone Laboratories; in particular to Messrs. H. M. Stoller, E. R. Morton, H. A. Frederick and D. G. Blattner for cooperation and generous aid, including the circuit design and the data in the first five figures.

Photographs of the integrating neurovoltmeter, the circuit diagram and some characteristic curves are presented in Figs. 1 to 5.

As will be seen, the equipment comprises a two stage battery operated amplifier and a rectifier. The rectifier supplies a small current to charge an external condenser. After a test, a key discharges the condenser through a ballistic galvanometer which indicates the accumulated charge on the condenser. This is a measure of the average voltage applied to the amplifier during the period of test, if the result is divided by the time duration. The frequency range of the instrument is approximately 20-250 cycles with a maximum sensitivity at 70 cycles. The maximum input is 0.0031 volt from 6000 ohms at maximum gain. The maximum output of the rectifier system is 30 indicated microamperes to the 1 megohm resistance, under which conditions 1 microampere is delivered to the condenser.

The circuit has three tubes with resistors in their heater circuits to permit operation from a 12 volt battery. The 262B tube used as a rectifier operates on less than normal heater power to reduce emission potential and leakage currents. There is a switch in this circuit.

The shielded input transformer works from an impedance of 6000 ohms on the full winding or 600 ohms to the taps. This supplies a 310A pentode vacuum tube which is resistance coupled to a second 310A tube. The gain control potentiometer has ten stops of approximately 2 db. and an off position for adjustment and testing. The condenser shunted across the plate resistor materially reduces the response above 200 cycles.

The second 310A amplifier tube is resistance-transformer coupled to a 262B tube used as a rectifier. The load on the rectifier is one megohm and has no condenser across it in order to make the output independent of frequency distribution and wave shape. A microammeter reads the current through this resistance. Full scale deflection is reached before the previous tube is overloaded but the power is limited to protect the microammeter against injurious overloads.

The output from the rectifier is supplied to an external condenser of approximately 100 mf. through a resistance of 30 megohms. This limits the

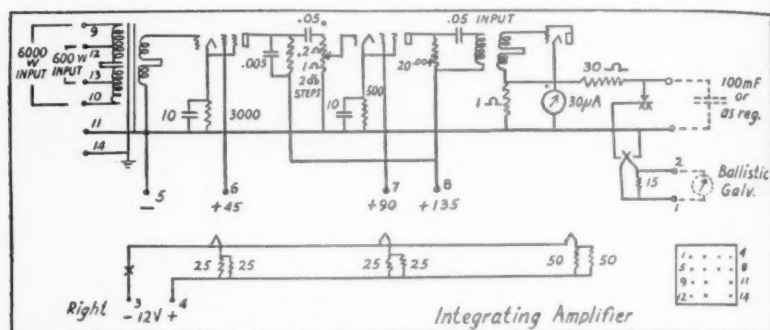


FIG. 2.—Circuit Diagram of the Integrating Neurovoltmeter.

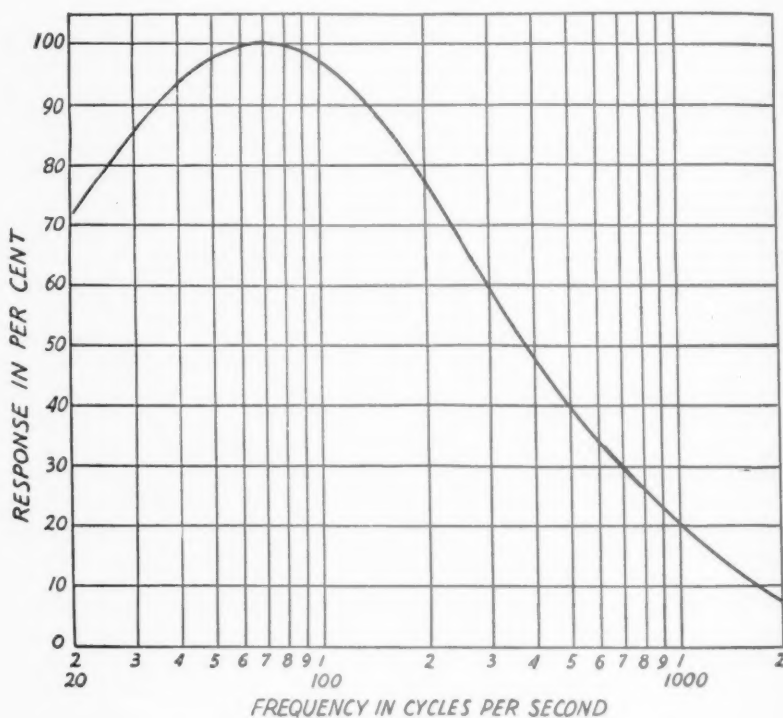


FIG. 3.—Frequency Characteristic of the Integrating Neurovoltmeter.

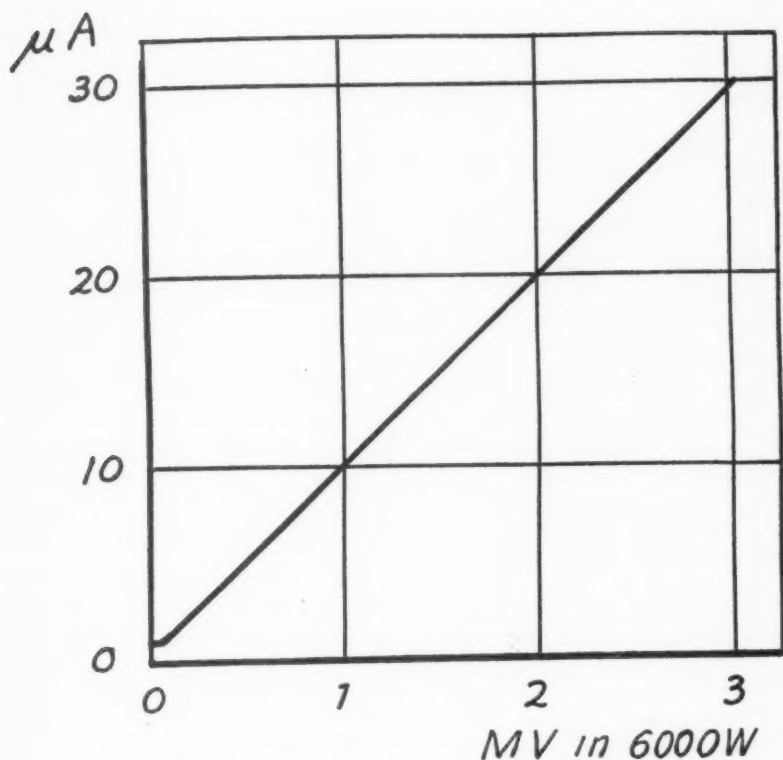


FIG. 4.—Current Output from Rectifier in Microamperes against Millivolts Across Input Terminals.

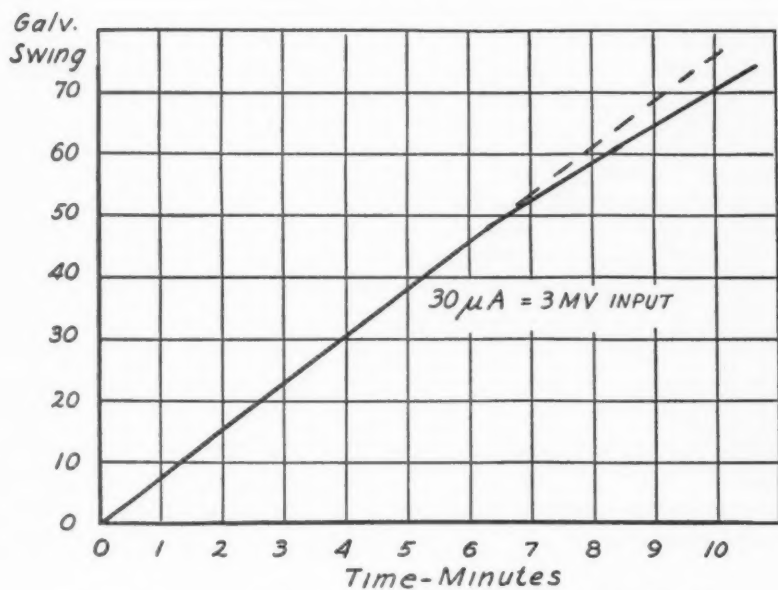


FIG. 5.—Condenser Charge Indicated by Galvanometer against Charging Time in Minutes—Voltage Input .003 Volt.

rate of charge and discharge of the condenser so that the accumulated charge over a ten minute interval is representative of the average voltage applied.

The charge on the condenser is measured by discharging through a ballistic galvanometer. An illuminated instrument is used—the Cambridge Instrument Company wall-type "fluxmeter" with the sensitivity—1 scale division = 3000 Maxwell turns.

The microammeter indicates the D. C. voltage applied to the condenser charging the resistance, and the current flowing into the condenser, provided that the condenser voltage is negligible compared to the applied voltage.

The value of 100 mf. was selected as a compromise between size and error due to accumulated terminal voltage at the end of a test. The galvanometer indicates the quantity of electricity discharged from the condenser. Therefore, any condenser sufficiently large so that the ultimate voltage is small compared with the applied voltage will indicate on the galvanometer the integrated average voltage for the period of the test.

A shunt of 18 ohms for damping the galvanometer is mounted on the reverse switch. This shunt may be varied somewhat to adjust the calibration of the galvanometer.

There are three factors tending to give low readings over an extended test; condenser leakage, discharge through the charging resistance during periods of applied voltage lower than the instantaneous condenser voltage and the condenser voltage opposing the charging voltage.

Calibration tests indicate that these are negligible on a five minute test, and are less than ten per cent on a 10 minute test. For averaging potentials over a longer period of time the condenser can be discharged at approximately 10 minute intervals and the galvanometer readings added to give the total integrated voltage.

Since the curve shown in Fig. 5 was recorded, the assembly has been set in a compartment supplied with soda lime to lessen condenser leakage. Accordingly, for ten minute periods the present curves tend to be more nearly linear. However, in place of 10 minute intervals, I have been taking readings as a rule at 2 minute intervals, in order to plot more points in the curve of action-potentials against time.

In application, the potentiometer has been left at step 10 from day to day. Variations of voltage sensitivity are effected as desired by means of a variable shunt resistance across the input terminals of the integrating neurovoltmeter (1-10,000 ohms, not shown in the figures). The leads from the subject pass to the input terminals of a transformer-coupled amplifier which performs satisfactorily within a frequency range from about 20 to 4000 cycles. On each day of use the readings secured with a particular shunt resistance can be standardized by applying an oscillator supply of 1, 10 or 100 microvolts (57 cycles) to the input terminals of this amplifier

during a unit period such as two minutes. Any reading thus secured must be corrected by subtracting the reading following a two minute period under the same conditions except that the filament circuit of the oscillator is not closed. Likewise, from each reading secured per unit period during which the potentials from the nerve or muscle are registered, the "short-circuit reading" must be subtracted. This is determined for a unit interval, using the same circuit constants except that, in place of the tissue, a comparable resistance, such as 1000 ohms, is placed across the leads.

During the past eighteen months, measurements of neuromuscular states have been made in healthy individuals as well as in others complaining of various symptoms. The procedure is extremely convenient, and at the end of a period such as an hour of measurements, the data can be corrected forthwith and are ready for inspection or for plotting in graphic form.

Records from electrodes in the muscles which flex the right forearm are illustrated in Figs. 6 to 8. As an example of "normal" behavior, the curve in Fig. 6 presents the mean potential differences in the electrodes in the muscles that flex the right forearm in a salesman evidently in good health. He lies on a couch with eyes closed and endeavors to relax. His age was 26 and he was selected because of his obviously placid disposition as well as because he was a highly experienced subject in basal metabolic determinations, for he sells this type of apparatus. As might be expected, the contraction voltages recorded are consistently low, at least after the first six minutes.

The magnitude of potentials recorded with any equipment depends in part upon the character, the size and the location of the electrodes used. For present purposes, these are fine, platinum-iridium wires, eleven-thousandths of an inch in diameter, which penetrate into the tissues five sixteenths of an inch. In the studies here presented, both wires are inserted into the muscle tissue at the same level proximal to the olecranon fossa (to avoid recurrent heart tracings). Doubtless this location reduces the recorded voltages, as compared with the usual location where one electrode is in tissue other than muscle.

These factors will explain in part the relatively low micro-voltages recorded; but experience shows that an additional point

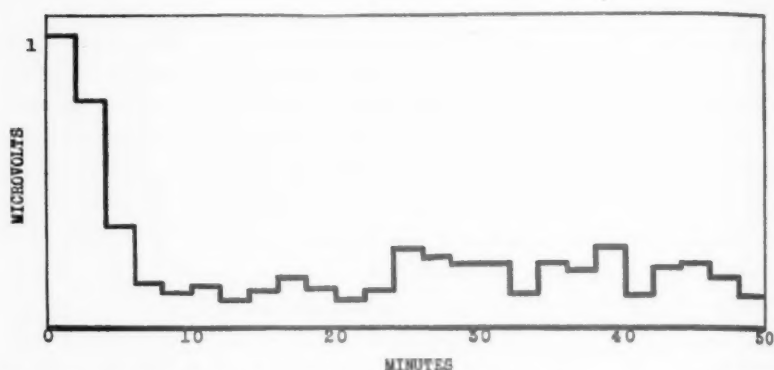


FIG. 6.—Action-Potentials in Electrodes in Right Forearm Flexor Muscles in a Quiet Normal Individual Lying with Eyes Closed.

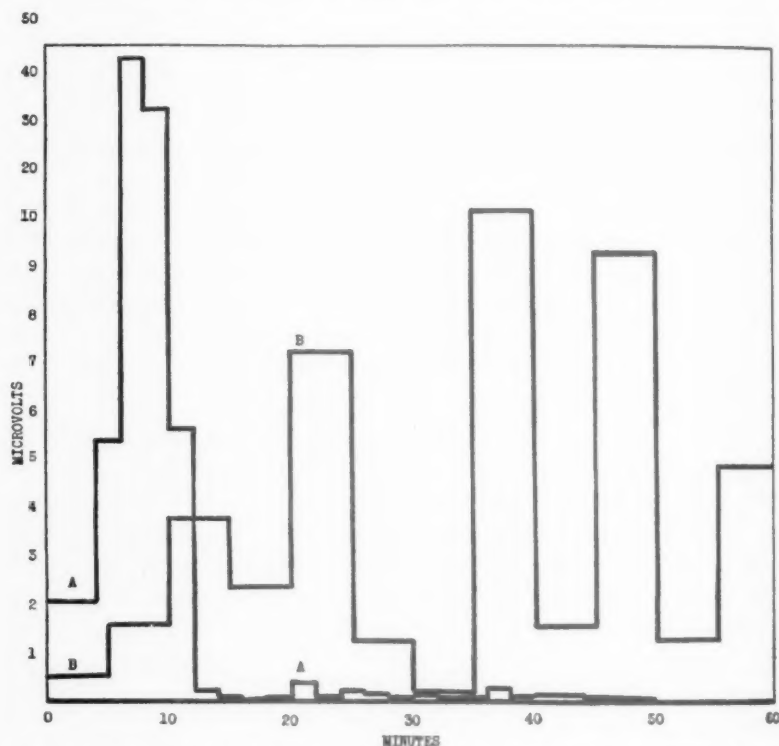


FIG. 7.—Curves from the Same Region in Two Nervous, Hypertensive Patients Lying with Eyes Closed (See Text).

deserves mention. Individuals vary in the degree to which the contraction in any one set of muscles may serve as an index of what is going on in other sets; indeed, in a strict sense, we find no such index anywhere. Nevertheless, to a certain extent, an accurate record secured from one set of muscles alone affords considerable suggestion as to what is probably going on in some other muscular regions, at least. For example, in an individual who is generally worried or "upset" at the time of recording, the microvoltages from

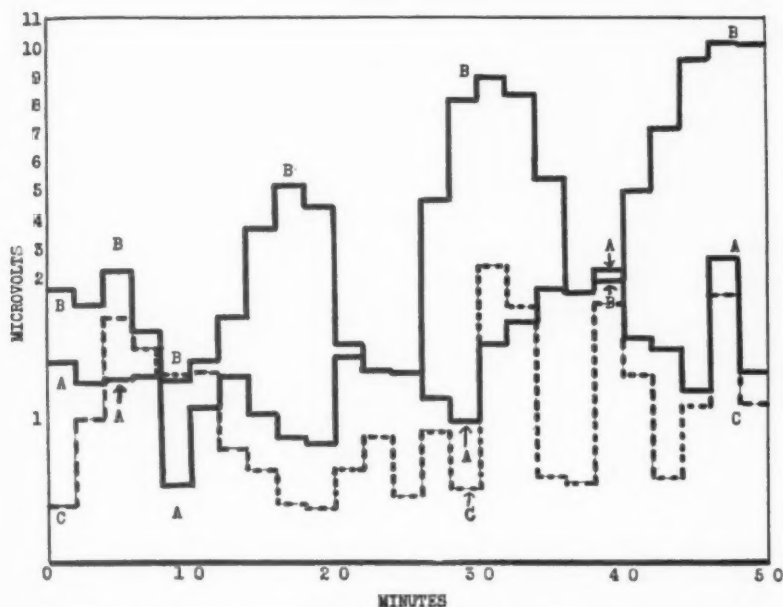


FIG. 8.—Curves from the Same Region in Two Men Sitting with Eyes Open (See Text).

any muscle group run considerably higher as a rule than those shown in Fig. 6.

In Fig. 7, curve A, is the record of a highly nervous woman, 38 years of age. She had been taking sedatives, probably barbiturates, up to the day of this recording. She is a bookkeeper and recently has begun to display brief spells of unconsciousness which are suggestive of epilepsy. This diagnosis rests on detailed accounts of the spells; for the present record enables us to infer no more than that she is in a highly nervous state. If any form of

treatment should reduce this excitability, a subsequent record made under the same conditions would serve admirably as a measure of the improvement in this respect.

Curve B in the same figure is from a doctor's wife, also recorded during rest. Although she has been accustomed for years to lie down about two hours per day after lunch for rest, she evidently fails to relax. If this is a fair example of her performance, it is no wonder that she complains of habitual insomnia, over-fatigue and nervousness.

As stated previously, recording can be effected with equal facility in the sitting posture, provided that the electrodes are not moved from their position. The subjects whose recordings are illustrated in Fig. 8 were sitting up during the period of measurement. One is an executive addicted not to worry but to overwork. During waking hours, his forehead and brow are seldom inactive. He is of the type popularly called "dynamic." During the recording, he was requested to sit as quietly as possible, but with eyes open. His right arm was supported comfortably. The record (Curve A) shows higher voltages than are often secured under similar conditions from persons of more phlegmatic type, such as the salesman represented in Fig. 6.

The curve B, in Fig. 8 was a surprising result. An elevator man noted for his calmness of manner sat reading a current periodical of his choice. He stated subsequently that he did not find the matter exciting, having read it previously. The voltages recorded are very high and if they do not arise with emotion, we should suspect that this individual makes great efforts when he reads. Upon inquiry his reports favor this view. His education did not extend beyond the first year of high-school and a thorough comprehension of what he was reading demanded efforts on his part. Following his custom, he reports, he tried to visualize carefully what was meant and he concentrated in an effort to retain the contents. Accordingly, it is not surprising that a control test made on a subsequent day, under the same conditions excepting that he was not reading, showed lower voltages throughout the period (Fig. 8, Curve C).

That the relatively high voltages displayed in the case of this individual indicate much effort on his part during his reading is further suggested by the finding in a number (21) of university

students (selected at random) that they tended to relax their legs during a period of reading or writing. As tested by the knee-jerk, it was concluded, they relaxed muscles whose action was unnecessary for the task—a state of adaptation which was termed differential relaxation.⁴ What we find in the instance of the elevator man evidently is a marked failure to relax differentially.

Measurements of the efforts made by students is an interesting example of the many possibilities which present methods thrown open in the field of education. Careful measurements by workers in that field as well as in medicine, if made upon large numbers of persons under conditions carefully controlled, doubtless can do much to extend our knowledge of man, in normal as well as in pathological states. An analogy may serve to make clear a certain service that this instrument may perform in medicine. Before the invention of roentgenograms, the evaluation of any form of therapy in a particular pulmonary disorder such as tuberculosis rested on general symptoms and signs, as well as on the opinions of the doctor and the patient. Today, we rely on x-ray films for objective evidence. In former years, we had no instrument of precision to measure nervousness (action-potentials in nerves) and tenseness (action-potentials in muscles) in man and guesswork played an important part in our conclusions. In the future, it is hoped, graphs made by present methods can be of service likewise in the daily practise of medicine for their diagnostic value and also for their objective determination of the influence of any form of therapy or the action of the nervous and muscular systems.

⁴ E. Jacobson, Differential relaxation during reading, writing and other activities as tested by the knee-jerk. *Am. J. Physiol.*, 86: 675-693, Oct., 1928.

QUANTITATIVE SEX HORMONE STUDIES IN HOMOSEXUALITY, CHILDHOOD, AND VARIOUS NEUROPSYCHIATRIC DISTURBANCES.*

By RUDOLPH NEUSTADT, M. D.,

AND

ABRAHAM MYERSON, M. D.†

In 1889 Brown-Séquard¹ exhibited himself to his colleagues in Paris after he had taken injections of a crude testicular extract over a period of two weeks. The audience agreed that the aged scientist was rejuvenated and the fulfillment of an old dream of mankind—the preservation of youth—seemed to be closer at hand. Unfortunately, the success of Brown-Séquard's experiment was not maintained.

Experimentations with crude testicular extracts were continued, but later investigators (Pregl,² Zoth³) were unable to repeat Brown-Séquard's results. They concluded that the effects observed by Brown-Séquard must have been mainly psychological. However, this explanation is no longer tenable. More recent experimentations by Kuznetzov⁴ (1928), Ptasjek⁵ (1928), Korenchevsky^{6, 7, 8} (1921) and others showed that definite physiological results can be obtained by the use of testicular extracts. Although the various authors differ in their results as to what phase of physiology is altered by testicular injections, the fact that there is a physiological influence has been firmly established.

The study of sex hormones was put on a firm foundation by two lines of development, namely, the establishment of biological tests for the quantitative measurement of sex hormones on the one hand, and their chemical exploitation and synthesis on the other.

* From papers at the Boston Society of Psychiatry and Neurology, Boston, Mass., March 21, 1940, and at the sixty-sixth annual meeting of the American Neurological Association, Rye, N. Y., June 7, 1940.

† From the division of psychiatric research, Boston State Hospital, Boston, Mass., aided by grants from the Commonwealth of Massachusetts, the Rockefeller Foundation and the Charlton Research Fund, Tufts College Medical School.

The test of Allen and Doisy⁹ for the measurement of the estrogenic activity of biologic materials was pioneer work. Similar work for the quantitative determination of androgenic activity was performed by Gallagher and Koch.^{10, 11} These two biological tests have been the basis of and paved the way for the exploration and standardization of female and male sex hormones.

During the last decade, progress in the knowledge of the sex hormones has been very definite and rapid. Organic chemistry entered the field of research and by the discovery of the chemical structure of a considerable number of sex hormones, their chemical relationship to one another, their occurrence in biological materials and finally their synthetic development threw a flood of light on the problem of the sex hormones.

There have been five principal groups of workers on the chemistry of the sex hormones whose importance must be stressed: Ruzicka and Wettstein leading the work in Switzerland; Butenandt in Germany; Laqueur in the Netherlands; Korenchevsky, Callow and Marrian in England and Canada; Marker and Kamm in the United States. The interested reader is referred to the original papers of these authors, and especially to Fieser's book¹² on the subject, as well as to the reviews of Goldberg,¹³ Marrian¹⁴ and Korenchevsky.¹⁵

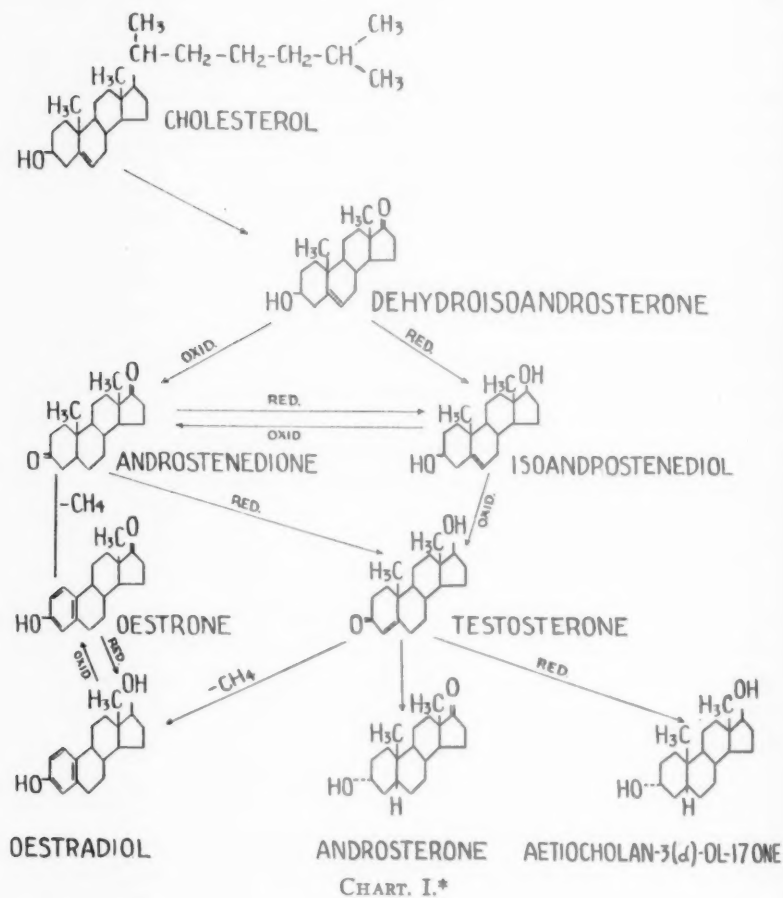
The sex hormones which can be determined at the present time are related to phenanthrene and, therefore, related to bile acids, vitamin D and cholesterol from which they can be synthesized. There is some evidence that in the body the hormones are produced from cholesterol (Cook¹⁶); Reichstein,¹⁷ however, believes that the reverse relationship exists.

Chart I shows the chemical relationship of various substances with sex hormone activity to cholesterol.

This chart also shows the substances which we determine routinely in the urine as combined estrogens and androgens. Oestrone and oestradiol are the "female" hormones of our routine examinations, and androsterone, aetiocholan-3-(*a*)-ol-17-one and dehydroisoandrosterone are the three hormones which throughout the text are referred to as "male" hormones or androgens.

Testosterone (Chart I) holds a central position amongst the "male" hormones. It is that male sex hormone which is formed in the testicles and which was isolated from testicle-extracts by Laq-

neur and his co-workers.¹⁸ At the present time, however, no chemical or biological method exists for the determination of testosterone in those materials with which we are working in a clinical laboratory—blood and urine; we are only able to determine in blood



and urine the transformation-products of testosterone, namely, androsterone, dehydroisoandrosterone and aetiocholan-3-(α)-ol-17-one (Callow^{19, 20}). The fact that it is impossible to determine testosterone makes all human sex hormone studies preliminary and incomplete.

* Combination of charts of Marrian¹⁴ and Goldberg¹³.

Although the three afore-mentioned male sex hormones are transformation products of testosterone, they are not exclusively derived from it (Callow ²¹). In part they are formed in the adrenal cortex (Reichstein ¹⁷) and there is evidence that both female and male substances are partly derived directly from the steroids of the skin (Engel, ²² Myerson and Neustadt ²³). We must, therefore, differentiate between the "genital" and the "extra-genital" part of the sex hormones. If we were able to carry through this differentiation in our experiments and examinations, it would probably be of as much diagnostic and therapeutic importance as the differentiation between leucocytes and lymphocytes in a blood count.

One rather recently discovered fact is worth mentioning at this point, namely, that androgenic and estrogenic substances are excreted in both sexes (for the extensive literature on the subject see Korenchevsky ¹⁵). We found in our own examinations that males usually excrete more androgens and females more estrogens than the opposite sex; however, the results in our experiments are so widely overlapping in both sexes that it is often difficult to determine whether a given urine specimen is from a male or a female individual. Other workers ²⁴ find that the amounts of androgen and estrogen excretion in both sexes are even more parallel than we do.

Another peculiarity which cannot be overlooked is the fact that androgenic substances show some estrogenic activity in biological experiments, and vice versa.

The above statements indicate the difficulties encountered in interpreting these laboratory findings in clinical terms and show the necessity for continual criticism and precaution.

METHOD.

At present there is no satisfactory method for the extraction of androgens from the blood which can be applied in clinical examinations of human beings. The blood, after leaving the glands and after passage through the tissues, would be the logical place for their determination, since the urinary determination is a measure of the excretion rather than of the manufacture of hormones. However, there is no evidence of an appreciable amount of storage of

hormones in the body since excretion roughly parallels their injection. We may, therefore, take urinary examinations as a rough measure of actual biological-sexual metabolism.

The methods of extraction of androgenic substances from urine have improved greatly since 1929, at which time Loewe and Voss²⁵ used 3.6 liters of urine to extract a biological active amount. The work of Koch²⁶ and his associates was an important step towards the improvement of the extraction methods. Space forbids the citation of other important workers. At present one liter of urine will produce sufficient hormones for biological testing.

After extraction of the active substances from the urine, the final quantitative step may be a bio-assay, as for example, measurement of the comb-growth of castrated cocks (Gallagher and Koch¹¹) or of newborn chicks (Breneman²⁷). Or the final quantitative measurement may be done by colorimetry. Tests of this kind are based upon Zimmermann's²⁸ discovery of the color-giving qualities of various sex hormones. Quantitative colorimetric tests for measurement of androgens have recently been described by Oesting,²⁹ Callow³⁰ and Neustadt.³¹

The choice between the use of the bio-assay and of the colorimetric determination will depend upon the purpose and the facilities of the individual worker. Each method has its individual merits and pitfalls. It seems necessary to state that we cannot expect and do not get a perfect coincidence between bioassay results and those obtained by the chemical test. Such a coincidence is present only in the medium range of values, whereas in cases with extreme amounts special and individual consideration is necessary. In general and after due consideration of the difficulties, it may be stated that for clinical purposes the superiority of the colorimetric test seems established.

Our work has concerned itself with the chemical determination of hormones. The method for androsterone, published in 1938, is simple enough to be carried out by any experienced technician. Since it excludes subjective errors, it is precise enough for clinical purposes. It is inexpensive and, therefore, can be performed as a standard laboratory method. It is quickly carried out, so that the clinician gets results 24 hours after sending in material instead of two weeks or later as is the case with the older bio-assay method.

A similar photolorimetric method for the determination of estrogens, published by Venning and associates,³² has been used by us for one and one-half years. In order to make this method applicable to non-pregnancy urine, slight changes in the final steps of the method are necessary.

GENERAL CONSIDERATIONS AND OUR MATERIAL.

The belief that disturbances of the endocrine glands or, more specifically, disturbances of the sex glands play an important rôle in the pathogenesis of various neuropsychiatric conditions is an old one. Clinical indications in this respect are so obvious that they cannot be overlooked, as for example, that in the psychoses there is marked impairment of the menstrual function in females and an equally important injury of potency in the male. Moreover, the prevalence of masturbation, the failure of sexual interest and the contradictory preoccupation with sexual delusions and sexual matters of mentally sick people are very apparent and, consequently, have been given a great deal of consideration. However, in spite of these numerous clinical indications, and although an enormous amount of work has been done, the actual facts at hand are very few.

While the sexual disturbances in the psychoses originally stimulated our research interest, the marked findings in our cases of sexual abnormalities deviated our interest from this course to the questions of sexual development and sexual constitution. Therefore our findings in the psychoses are still scanty.

Up to the present time more than 650 examinations have been performed, the first 600 of which are evaluated in the present report. Fifty-six per cent of our examinations concern male hormone determinations and 44 per cent female hormone determinations. The urines of 200 individuals have been examined, which include normals, neuroses, psychoses and endocrine disturbances. Occasionally these groups may overlap in so far as a patient may be an imbecile and myxedematous, or epileptic and amenorrhœic, or a schizophrenic and homosexual; such cases would appear in both of their corresponding sub-groups. These, however, are the exceptions and the majority are classified only once.

FINDINGS IN VARIOUS CLINICAL GROUPS.

A. ESTABLISHING A STANDARD.

Before we were able to evaluate our findings, we had to collect enough data to establish a standard. Standardization seemed to be difficult because previous reports in the literature, based upon animal experiments, tended to indicate that hormone excretion of the same individual varies so widely from day to day that any attempt to establish a norm seemed to be impossible from the very beginning. However, our examinations do not confirm the older reports in the literature but show, on the contrary, a marked tendency towards stability of hormone excretion under unchanged conditions.

The urine of 5 male individuals of 9, 16, 28, 46 and 51 years of age was collected and examined twice weekly for periods of 8 to 12 weeks each. These examinations revealed that variations in androgen excretion per liter of urine are considerable; that, however, androsterone excretion per day is strikingly uniform. Daily excretion in the boy of 9 years showed as little change as between 52 and 53.8 units; the male adult of 51 showed no greater variations than between 120 and 130 units daily; and similar results were obtained in the other 3 patients.

Our experience in most of the other patients is the same. As 600 examinations were performed on 200 individuals, each person's urine was examined on the average three times. Repetition, as a rule, showed the same result as the first examination. Whenever changes did occur, they could be accounted for on the basis of treatment or an excess of solar irradiation. There was only one instance of a change from "low" to "medium," the reasons for which are unknown to us.

In view of previous reports of other workers who found wide variations in the amount of daily excretion of androgens, the uniformity of our results may seem surprising. In a previous paper,²⁸ we offered as one of the possible explanations for our findings the fact that our patients live under uniform hospital conditions. Meanwhile, however, we could follow for weeks and months the excretion of androgens of patients who do not live under hospital conditions. Since these patients, too, do not show appreciable varia-

tions—as is the case of the majority of the patients with only one or two examinations—the previously offered explanation is inadequate to explain the more uniform results obtained with our colorimetric method. There must be, at least in part, differences in the methods themselves which are responsible for the differences in the results. For all practical purposes, the constancy of the

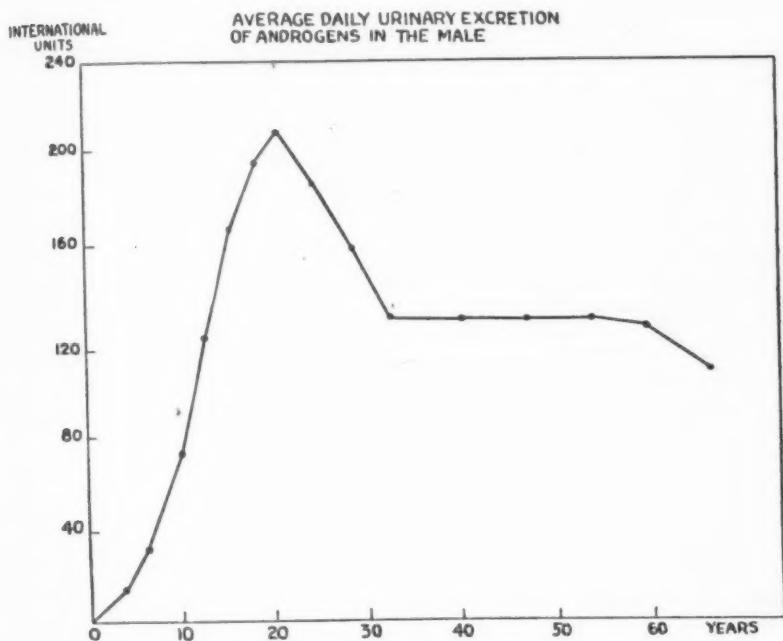


CHART II.

results obtained by colorimetric measurement is a decided advantage over that of the bio-assay.

Having established the results as stable and uniform in themselves, we divided our patients into various age groups. In summarizing the results of each age group and dividing them by the number of examinations performed, we get the curve of Chart II, which we regard as representing the average daily excretion of androgens in the various age groups. We find low readings below the age of 10 years, then a sharp increase up to 21 years, a decrease during the next decade, a plateau from 31 to 55 years, and then a

decline. The average daily excretion between 30 and 55 years is about 130 international units with a range of variation from 90 to 170 international units per day. This curve concerns the excretion of males only, since in females the problem is more complicated because of the cyclic variations. Estrogens follow the androgens in adults closely; their excretion is highest in early maturity, is fairly uniform in the middle period of life, and shows a decline in old age.

A curve based upon a relatively small number of examinations in each age group contains a relatively large mathematical error. Therefore we may expect changes in this curve when we shall have performed ten times as many examinations as we have done now. However, these changes probably will concern only the relatively small age groups at the beginning and the end of the curve, while changes in the middle years of life—where the bulk of our present patients belong—are unlikely.

In this paper, when we speak of high or low values, we mean that the individual readings have been plotted against the standard curve of the same age and that the amount of urine, its pH, irradiation of the patient by ultraviolet or sunshine, therapy and other factors which are known to influence the colorimetric readings have been taken into account.

B. HOMOSEXUALS.

This group comprises 29 individuals, 11 of whom (Chart III) are male homosexuals from the private practice of one of us and 18 (Chart IV) were patients selected from various state hospitals. A somewhat larger number of patients who had some homosexual tendencies was offered to us for examination; these, however, were excluded because they did not seem to us to present true homosexuality. Our criteria for true homosexuality are simple enough: overt homosexual conduct as the predominant and preferred sexual activity, with or without physical stigmata. Patients were excluded from this category where homosexuality was forced upon them by others, as occurs occasionally in state hospitals, and where the *predominant* sexual activity was either heterosexual or masturbation.

The literature on hormone examinations in homosexuals is as yet scanty. Wright³³ in 1935 stated that in homosexuality the ratio of male and female hormones is disproportionate, that is, there is more

female hormone than is usual as compared to the amount of androgens. Recently Glass, Deuel and Wright,³⁴ using improved methods on a greater number of patients (17), reached the same result.

Our work, which has been done independently and without knowledge of the work of Wright and his associates, consists of 29 true male homosexuals examined during the last two years. Of these 29 patients, 25 show a strikingly characteristic disproportion between the male and female hormones.

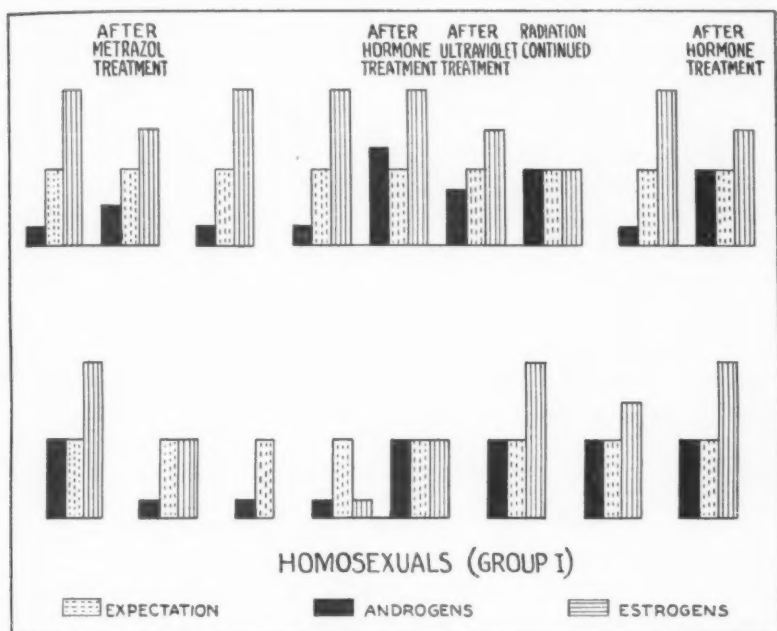


CHART III.*

In 10 of the 11 private cases, before treatment we find one of two possible deviations from the norm: there is either a deficit of androgens combined with a normal amount or excess of estrogens,

* Explanation of the charts: the dotted block shows the amount of androgens and estrogens which is to be expected according to age and other conditions of the individual. The black block (androgens) and the striped block (estrogens) indicate the proportionate deficit or excess of androgens and estrogens.

or there is a normal amount of androgens combined with an excess of estrogens. In either case there is a distinct disproportion of the normal ratio male: female in favor of an excess of estrogens.

In the one exception there was a low male and female hormone level to begin with (this is the case previously mentioned in the section on standardization), and then for some reason unknown to us the patient developed what seemed to be a normal hormone level in both sexual fields. This male has very definite homosexual tendencies which he has managed to conceal. However, he consulted one of us for his homosexual feelings, in which he yearns to take the feminine rôle.

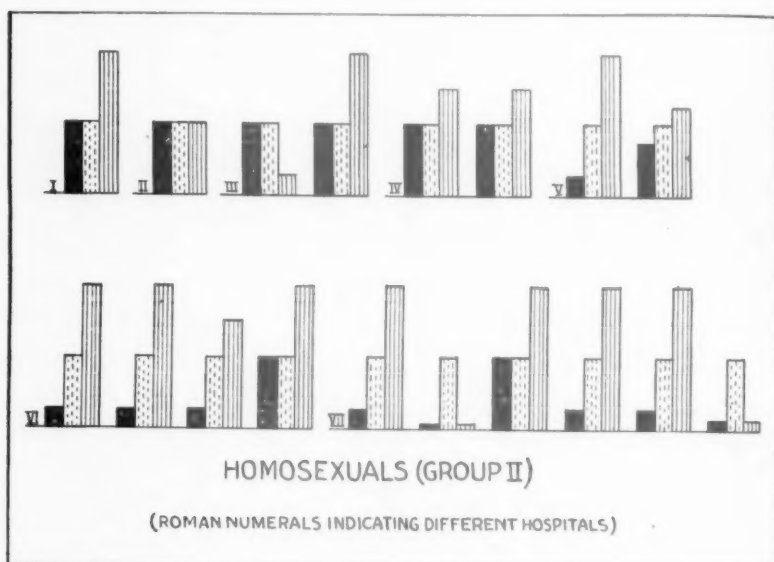


CHART IV.

Treatment of a few cases by testosterone injections produced no essential change in the homosexual feelings or conduct, although the urinary findings were changed. One patient, who at first was treated by hormone injections and whose treatment, after an interval, was continued with ultraviolet irradiation, showed clinical improvement accompanying the change in urinary findings. Improvement in both directions was maintained for several weeks only.

Of the 18 cases whose urines were obtained from several state hospitals (Chart IV), there were 3 which were exceptions so far

as their hormone output was concerned. One had a normal hormonal output (Hospital II). However, we have not personally examined this male and can only accept the statement that he is truly homosexual. The two others (Hospital VII) showed practically a complete lack of hormones. One of these is definitely a case of diabetes insipidus in which condition, according to our present studies, there is a lack of sex hormone excretion. The second case is not accounted for by any examination which we have made and will be further studied.

In two instances (Hospital VI), the questionnaire sent to the hospitals after completion of the urine examinations stated: "Slightly feministic signs." All other patients were characterized as of masculine stature. Both patients with feministic stigmata belong to the group with severe discrepancy in the ratio male: female excretion.

In summarizing our findings on homosexuals, we may state that in 25 out of 29 cases there was a uniform or nearly uniform staircase type of hormone excretion, with the male hormone relatively low and the female hormone relatively high. This staircase sign is not solely correlated to the physical build of the homosexuals, but mainly and primarily to their overt homosexual conduct and feelings. We believe, therefore, that the staircase sign of hormone excretion in homosexuals, indicating an excess of estrogens, is on the whole characteristic and pathognomonic.

C. MISCELLANEOUS SEXUAL ABNORMALITIES.

The discussion of this small group of 6 patients follows that of the homosexuals because 5 of the 6 urines were sent to us from various sources together with urines of overt homosexuals. Later investigations showed, however, that they were not homosexuals according to our criteria.

The results of this group as a whole (Chart V) are quite different from the results obtained in the two groups of homosexuals; this difference was evident in the clinical symptoms as well.

One patient who showed a normal urine (Case I, Chart V) was, generally speaking, physically and mentally immature and a masturbator, and whatever homosexuality occurred was forced upon him. A second, showing a "high normal" amount of androgens and a low estrogen excretion was, in

reality, a rapist who practised sodomy and was indiscriminate in his sexual drive. He represents the only case of sodomy in our entire series.

The third case, which can be classified as a transvestist, was obsessed by the drive to dress in female clothing, apparently to increase his male sexual desire. Both his androgen and estrogen excretion showed the expected value. This case may be linked up with a case from the private practice of one of us (Case 6, Chart V); a man, essentially masculine in physical characteristics and with a normal hormone level, who had transvestist tendencies of a strong

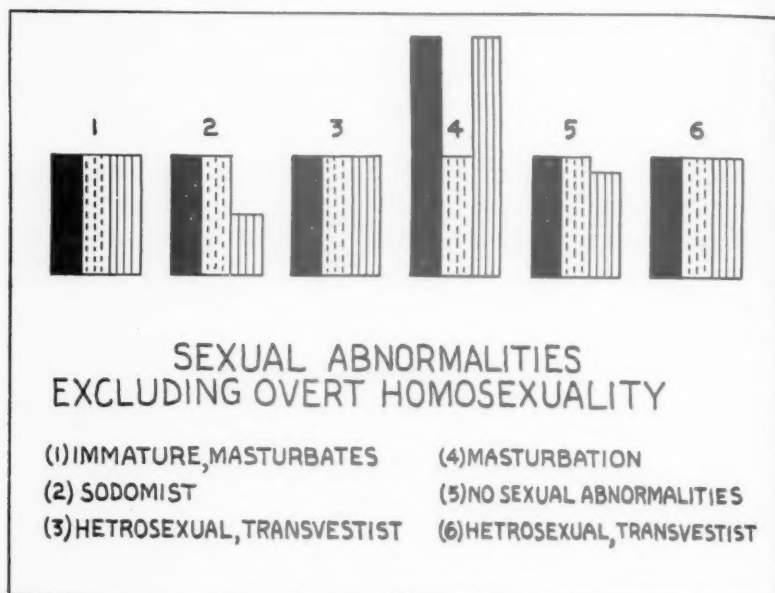


CHART V.

type from this thirteenth year onward. He later married and is potent with his wife. His transvestism is a device by which he reaches high sexual excitement and either masturbates, if there is no woman to be had, or has heterosexual relationships. He has no homosexual tendencies either in overt conduct or in desire.

A fifth case in this group (Case 4, Chart V) was primarily a masturbator of inveterate type, had a high male and female level and whatever "homosexuality" he had was on the basis of a psychoanalytic interpretation. The last case showed no sexual abnormalities in so far as we could discover, but his homosexuality, like that of the preceding case, was based upon psychoanalytic interpretation of conduct.

D. IMPOTENCE.

This group comprises 12 individuals whose major complaint was impotence. Mentally depressed patients with loss of sexual desire and activity were not included in this group. Patients of this kind were classified as depressions and show, on the whole, no definite deviations from normal expectation. The patients classified in the group of impotence suffered, in the main, from minor

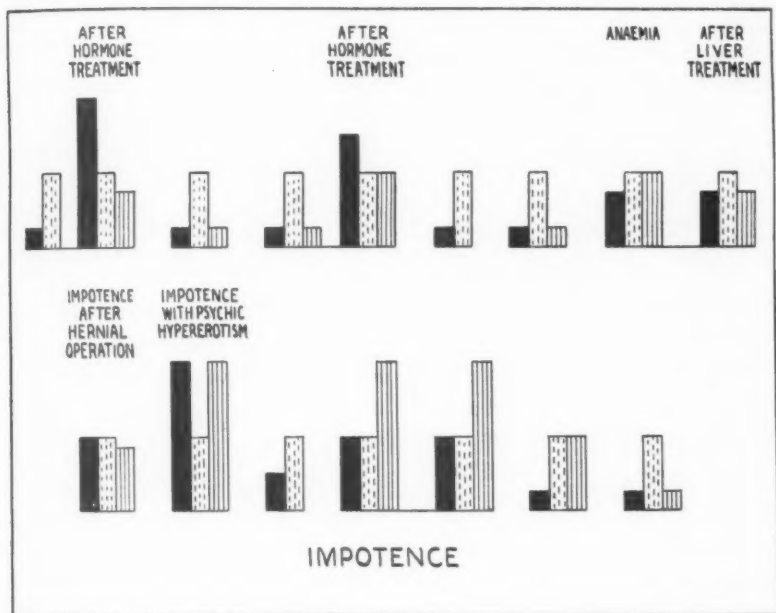


CHART VI.

neuroses, with the most conspicuous symptom *ejaculatio præcox* with poor erection. Hospitalized patients are not included in this group.

Eight of the 12 patients show a low hormone level, both on the male and female side before treatment (Chart VI). These 8 patients present no special physical problems and represent cases of impotence on a neurotic basis.

The four remaining cases of this group merit separate consideration.

One, a borderline case of pernicious anemia, showed general physical improvement as well as improvement of his blood count after liver therapy; this was accompanied by an increase of potency, although full potency was never reached. His hormone excretion was practically normal during the time of observation and not influenced by treatment.

A second case, a man of 44 years of age, complained of impotence starting immediately after a bilateral hernia operation. The urine examination, made about 2 months after operation, showed no pathological findings at that time. A third case was labeled "impotence with psychic hypersexuality." The excretion of both male and female hormones was so high that we suspected a tumor of the adrenal cortex; as the case was not followed up by the clinician, this possibility has not been excluded.

Finally, in a fourth case repeated examinations showed the staircase sign which we found so often in homosexuality. This man had a neurosis; his sexual relations were entirely unsatisfactory because of his impotence. He showed no feministic stigmata and entirely denied homosexual tendencies in conduct or feeling. His case must be considered unsolved at the present time.

Cases of this type are a warning against premature diagnostic conclusions on the basis of hormone examinations of the urine but certainly serve as a stimulus for further research.

Testosterone injections in two cases of this group greatly increased the hormone level, but did not improve the impotence to a corresponding degree. However, treatment in both cases was not carried out for a long period and continuation of treatment might have produced better clinical results.

E. MASTURBATION.

This group comprises 7 patients, 6 of whom were cases of masturbation from private practice in which mental disease could be excluded; the seventh case is the previously mentioned patient of a state hospital with suspected homosexuality who turned out to be a masturbator. During the preparation of the present publication, no information could be obtained as to whether the patient labeled as "impotence with psychic hypersexuality" could have belonged to the group of masturbators. At the time of the examination of his urine, we were not yet familiar with the "hormonal formula" of masturbators.

Six of the 7 cases of this group showed a very high hormone level in excretion of both androgens and estrogens (Chart VII).

The exception in this group is the state hospital patient who was regarded as physically immature. The remaining 6 patients were

physically well developed (5 males, 1 female). There is a remarkable and definite decline in hormone output in one patient after psychotherapeutic treatment.

The number of our cases is too small and the problem of masturbation too complex to permit dogmatic statements. High hormone formation and excretion may be the cause of masturbation, or vice versa, masturbation may be a stimulus to excessive hormone formation. Authentic knowledge on this subject is lacking at present. Empirically we can state that the increase of androgens and estrogens is highly characteristic of the masturbator.

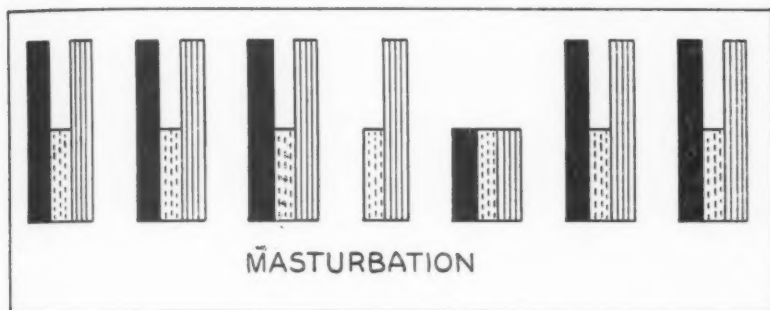


CHART VII.

F. CASTRATION AND EUNUCHISM.

There were 2 female castrates among our patients. In both instances, the castration was performed as a therapeutic measure and in each the total amount of excreted substances was very low, both in the androgens and estrogens. This is according to expectation.

The male castrate is interesting enough to be mentioned separately. He is a dementia præcox patient, 42 years of age, who castrated himself radically at the age of 17. He now presents marked female bodily structure with large female breasts, rounded bodily development with female adiposity, female pubic hair, and a relatively hairless face. The urine of 4 days was examined in his case. The total amount of excreted hormones was very low, so low on the female side that it came within the range of error of the method. Androgens were 78 units per day, this being decidedly below the lower border of what we regard as normal, but far higher than our findings in thyroid or pituitary conditions. The urine, therefore, was divided in several portions

and further examined chemically, according to the directions given by Callow.³⁵ The final portion, which we have to consider as containing the pure androsterone, revealed 45 units. This means that even in a eunuch of 25 years' duration, more than half of the excreted male hormones is present in the form of androsterone. We note in Callow's²⁰ paper that these authors found similar results in their cases of eunuchs.

G. VARIOUS ENDOCRINE CONDITIONS.

The report on this group is short and preliminary, because while each case needs special consideration, the problems involved are mainly not of a neuropsychiatric nature. The full report of these cases, therefore, will be given in a separate communication.

Sexual Underdevelopment.—Of 7 cases with unilateral undescended testicles, 3 showed a low hormonal level, 2 very low and 2 definite normality. These latter two patients were adults without further malformation and with normal male sex characteristics. The remaining patients with very low and low readings were either children or showed signs of underdevelopment in addition to undescended testicles.

Of 10 cases with menstrual difficulties and sexual underdevelopment, 3 were within the range of the norm, while 7 were definitely below it.

Three cases of *Froehlich's syndrome* were very low but not to the point of lack.

Adrenal Tumor.—Six cases in which the diagnosis of adrenal tumor had been made were examined. Five cases showed very high excretion of androgens (300 units and more), while one case was diagnosed by us as "high normal" (160 units). Another examiner found the same amount of androgens as we did; however, he regarded the excretion as pathologic in a girl of 16 years. An operation was performed against our advice and no adrenal tumor was found. In adrenal tumor the excretion of 17-ketosteroids is definitely increased at an early stage, as observations in recidives of operated adrenal tumors prove. A borderline result, therefore, points more against the existence of an adrenal tumor than in favor of it.

Hirsutism.—Four cases of this condition were examined. Two cases were high but within normal limits, and two cases low, which results are surprising. Further biochemical studies in these latter

two patients gave no definite clue in regard to their primary endocrine disturbance. The most marked case of hirsutism in our series showed low male and female hormone excretion.

Simmond's Cachexia.—Two cases, both showing a complete lack of male and female hormone excretion.

Diabetes Insipidus.—Three cases showing a complete lack of male and female hormone excretion.

Hypo- and Hyperthyroidism.—This group comprises 14 cases, 6 cases of hypo- and 8 cases of hyperthyroidism. The results of the biochemical studies will be published in detail in a separate paper. Of the 6 patients with myxedema, 5 of long standing showed low or extremely low male hormone excretion, as low as 30 and 50 units per day. It is remarkable that readings of this kind are lower than those in our case of eunuchism. The sixth case was an acute post-operative myxedema who was first examined about 8 weeks after operation when he complained about loss of sexual desire as part of his general fatigue and weak condition; he was re-examined after several weeks of thyroid treatment. In both instances, the male hormone excretion was normal, 160 and 170 units respectively.

The same difference is noticeable in our cases of hyperthyroidism, where out of 8 cases 6 chronic cases showed a very low excretion, while 2 cases were normal. Our estrogen examinations in hypo- and hyperthyroidism are still incomplete.

The remarkable fact thus far is that deficiency or excess of thyroid excretion of chronic type causes severe damage to the genital and extra-genital sites for formation of male sex hormones. The damage seems to appear earlier in the course of the disease in Graves' disease than in myxedema. It seems important to stress this fact because Callow's³⁵ publication on cases of "thyrotoxicosis with normal sexual function" gives the impression that his figures are normal; however, in 4 of 5 cases his figures are far below normal.

H. MISCELLANEOUS NEUROLOGICAL DISEASES.

The urines of several patients with organic lesions of the nervous system were examined. Although each group is too small for final conclusions the figures have distinct suggestive value.

Two cases of injuries of the spinal cord were both "low normal" in androgens. Two years later, one case showed "high normal"

readings after clinical improvement in both androgens and estrogens.

In the following cases male and female hormone content is recorded:

Tumor of spinal cord: one case, normal.

Epidemic encephalitis: two cases, both very low. Neither of these cases showed diabetes insipidus.

Myasthenia gravis: two cases, one low, one normal.

Scleroderma: one case, very low.

Pick's disease: one case, high.

The uniformly low levels of hormone excretion in diabetes insipidus, Simmond's cachexia, epidemic encephalitis and scleroderma indicate the necessity for further study of these diseases to discover the organic basis of the hormonal diminution.

I. MAJOR PSYCHOSES.

We are still in the process of collecting data on manic-depressive psychosis and schizophrenia. Our report on these psychoses, therefore, is incomplete and preliminary. The number of schizophrenics examined, about 30, is far too small to warrant conclusions on so complex a subject as schizophrenia, especially since many of our examinations of schizophrenics were performed either for chemical studies or because schizophrenia in these cases was complicated by an endocrine disorder. Thus far, our findings in this group range from very low to very high.

As it is difficult to collect the urine through one or more cycles of true manic-depressive psychosis, our material in this group is still too small to be reported on. However, a group of so-called involutional melancholia, although small in number, may be mentioned at this time. The belief that depressive states and true depressions at the time of the male or female climacteric are associated with or caused by hormonal disturbances is fairly widespread amongst psychiatrists.

We compared, therefore, a group of 6 patients with involutional melancholia with another group of the same age but free of psychotic symptoms (cases of prostatic hypertrophy, moderate arteriosclerosis, etc.) (Chart VIII).

Comparing the 6 depressive cases with the 6 non-psychotic cases, we find in both groups 3 with entirely normal excretion, one in

each group with excretion slightly below normal, one other in each group with increased amounts of hormones, and only one in each group with an excretion so low that it may be regarded as a definite deficiency. The distribution of normal and abnormal findings is exactly the same in the psychotic and non-psychotic groups, and it seems, therefore, reasonable to assume that the mental symptoms are etiologically independent of the hormonal state. We may tentatively conclude from our findings that hormonal regression, if

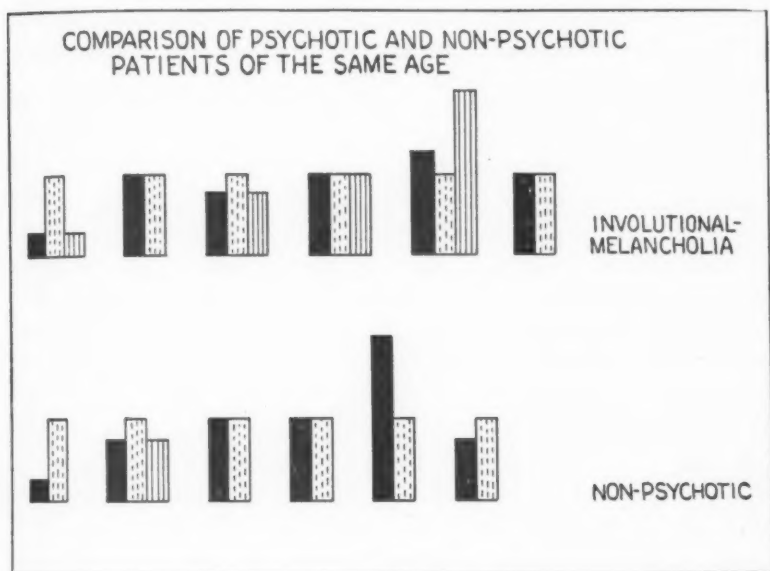


CHART VIII.

present, is an accompanying and not a pathogenetic factor of the depressive psychoses in the 6th decade of life.

The question of hormone deficiency in involutional melancholia is of practical importance, since on the basis of theoretic considerations and rather strong recommendation, especially by Werner,^{36 37} hormone treatment of involutional psychoses has become a fashion. The three most recent reports on hormone treatment in involutional psychoses are agreed, however, that endocrine therapy does not influence the course of the psychosis (Schube,³⁸ Hutton and Schiller,³⁹ Ripley, Shorr and Papanicolaou⁴⁰). The latter authors

state that "The beneficial effect of estrogenic hormones was confined to the relief of vasomotor symptoms." This is the well-known effect of estrogen therapy in the menopause—whether complicated by psychosis or not. And no more than relief of vasomotor symptoms can reasonably be expected from hormone therapy. The negative results of hormone therapy in involutional psychoses are in complete accordance with our findings which point toward a negative relationship between hormone excretion and this group of psychoses.

J. HORMONE EXCRETION IN CHILDREN.

Since 1932 reliable reports have appeared in the literature concerning sex hormone excretion in the urine of children. Since the various authors used different methods of collecting, extracting and assaying their material, the actual figures in the various findings cannot be compared with each other. Yet in spite of these differences in details, the general outcome of the researches is uniform: Womack and Koch ⁴¹ (1932) found "no comb-growth stimulating hormone in the urine of boys under 10 years of age," while adolescent boys yielded amounts equal to that of adults. Dingemanse, Borchardt and Laqueur ⁴² (1937) reported that there was a small amount of comb-growth stimulating material in the urine of both boys and girls of about 5 and 6 years of age, but that the quantity was always below 15 international units, while adults excrete from 15 to 70 international units. Dorfman, Greulich and Solomon ⁴³ (1937) examined 18 boys and 5 girls from 7.8 to 16.3 years of age. They found that the amount of androgens and estrogens increased parallel to the general physical development of the children and was not directly related to biological age. Oesting and Webster ⁴⁴ (1938) measured the androgens present in the urine of 43 boys and 16 girls by the colorimetric method, and found a constant and gradual increase with increasing age and development of the children. The color-units of these authors are very similar to our own findings. Finally, Nathanson, Towne and Aub ⁴⁵ (1939) report on their examinations of the urine of 87 children from 6 to 17 years of age and in detail on the examination of 10 children (4 boys and 6 girls). They found that excretion of sex hormones varies with physical development as well as with chronological age.

Variations in androgens, as measured by colorimetry in successive examinations, were small and offered no suggestion of a cycle.

Our own material (Chart IX) consists of 33 children (21 boys and 12 girls) from 5 to 16 and from 3 to 16 years of age respectively. Forty-seven examinations were done on this material. One boy, 7 years of age, with adrenal tumor and one girl, 6 years of age, with a cystic ovary, are excluded because they showed definite pathological findings. Our cases, except for these latter two, are only in part normal (6 cases), that is, children who are not under medical care and present no mental or physical problems. In addition, there were 7 problem children from Dr. Douglas A. Thom's Habit Clinic with minor psychic problems. There were 6 cases of organic neurological disease; 6 cases of unilateral undescended testicle and obesity, and 5 cases of acute physical disease of other types (gastric hemorrhage, appendectomy, etc.). However, examination shows that this diversity of our material is no handicap in reaching a conclusion, since there is no direct relationship between the various clinical conditions studied and the quantity of hormones determined. The important factor seems to be the general physical development of the individual and the actual development of the sexual organs.

Chart IX shows that there is a gradual increase in androgens in both sexes. In all cases where the individual results are much lower or much higher than the average of the same age group, we find general under-development or over-development.

Androgens in boys reach a higher level and the increase starts earlier than in girls. At the age of puberty in boys 13 to 16 years of age, the increase is more rapid than in the pre-puberty group, 6 to 12 years of age.

The increase in androgens in girls is steadier but does not reach as high a level as in boys of the same age.

The excretion of estrogenic substances in boys starts around the 9th year of life; the increase of estrogens seems to follow the androgenic increase in proportionate measure.

It is interesting to note that at the height of puberty the androgen excretion in boys is higher than in the middle-aged male, although it is less than during the period from 16 to 21 years when it reaches its peak.

It may thus be stated that the literature and our findings are in complete accord, and it may be stated definitely that the overt sexual development of the individual is directly correlated to the

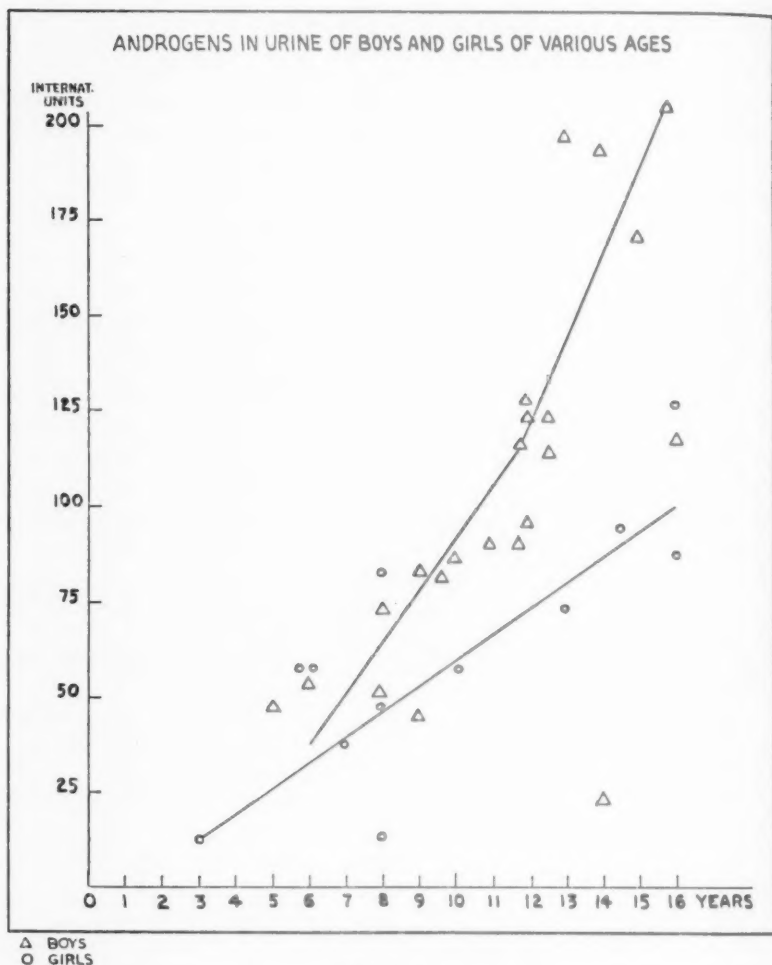


CHART IX.

amount of androgens and estrogens excreted in the urine. Neither the bio-assay nor colorimetric determination give any evidence that very young children have any active sex hormones.

These findings are of psychiatric interest, because the statement is so commonly made that there is a homosexual component in the

sexual life of children. We have shown above how different sexual types and especially homosexuals present a definite hormonal formula, but we find nothing in the urine of normal children which compares with the findings in homosexuals, nor is there any mention in the literature of any increase in female hormones in young male children.

Therefore, the disciples of the belief that homosexuality and other sexual perversions appear in childhood must base this belief upon symbolic interpretations of conduct rather than upon actual findings.

K. PHYSIOLOGICAL OBSERVATIONS.

In a previous publication we have shown that ultraviolet irradiation produces a quick rise in hormone excretion and that this rise is greater after direct irradiation of the testes than after stimulation of other parts of the body of similar size. The level of hormone excretion cannot be raised indefinitely by ultraviolet irradiation. The first stimulation is the most important one and after a short time, usually within 2 weeks, the peak of the hormone excretion is reached. A noticeable increase can be gained only if one starts at a low level. After the ultraviolet irradiation ceases, the hormone level quickly sinks to former levels.

That the colorimetric increase in hormones is actually due to increased active hormones is shown by animal experiments (Chart X). In the 5-day chick test, according to Breneman,²⁷ the growth of comb and wattles of the newborn chicks is definitely greater after injection of urinary extracts of irradiated patients than after injection of urinary extracts of the same patients before irradiation.

We believe that raising the hormone level by ultraviolet irradiation is probably the most nearly physiological way of restoring a disturbed hormone balance. This is one of the reasons why ultraviolet irradiation was introduced as part of the "total push" method⁴⁶ for the treatment of chronic cases of schizophrenia.

L. DISCUSSION.

In applying endocrine research to neuropsychiatric questions, we are confronted with problems of at least four different kinds:

there may be psycho-somatic relations in the psychoses, or vice versa, there may be somato-psychic relations; there may be inter-somatic relations in organic diseases with the primary cause either in the central nervous system or in the endocrine glands; and, finally, there may be a mere coincidence between an existing gland disturbances and neurological or psychiatric disease of any type. Although during the last 20 years progress in the knowledge of sex hormones has rapidly advanced, it has not yet advanced far enough to illuminate the complicated relationship between endocrinology and neuropsychiatry. Further results may be expected as soon as a differentiation between the genital and extra-genital part of the sex hormones can be carried out as a routine examination of a clinical laboratory.

Although numerous clinical observations have been made suggestive of the importance of disturbances in sex gland function in psychoses, the actual knowledge of this phase of the subject, so far as laboratory findings are concerned, is still scanty. Our own examinations in the psychoses are still too incomplete to throw light on the situation. However, we may state that there are negative relations between the decline of sexual activity and involutional melancholia. These are merely coincidental factors.

Three points stand out quite clearly as the result of our examinations: One is the importance of inter-glandular relations, as demonstrated by the decline of sex hormones in hypo- and hyperthyroidism. The second is the confirmation by clinical observations of the importance of the pituitary and its adjacent area as a motor in sex hormone formation, as is indicated by the disappearance of sex hormones in Simmond's cachexia, diabetes insipidus, sclerodermia and similar conditions.

The most important result thus far obtained is the reflection of sexual development and sexual constitution in urinary hormone excretion. We know, of course, that urine examinations are not wholly reliable. However, in homosexuality, impotence and masturbation the coincidence between the clinical condition and urinary findings is so great that the results of urine examinations may be regarded as a true mirror of the biological basis in these conditions.



CHART X.—*A*, 10-day-old control; *B*, 10-day-old chick injected for 5 days with urine extract, corresponding to 140 international units; *C*, 10-day-old chick injected for 5 days with urine extract of the same patient as in *B*, after 3 radiations, corresponding to 240 units.

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1. Six hundred colorimetric determinations of androgens and estrogens were performed on the urines of 200 individuals.
2. A standard curve for the daily excretion of androgens and a norm for the ratio male: female hormones was established.
3. Of 29 overt homosexuals 25 show a very characteristic staircase sign, namely, male hormones relatively lower and an excess of estrogens.
4. Other sexual abnormalities, especially transvestism, do not show this staircase sign.
5. Of 12 patients with impotence, 8 cases on a neurotic basis show a very low excretion of androgens and estrogens; the remaining 4 cases show special problems.
6. Another characteristic finding appears in masturbators in whom 6 out of 7 patients show a very high excretion, both in androgens and estrogens.
7. In castration and eunuchism excretion is low; in a case of eunuchism of 25 years' duration, half of the amount of excreted androgens was present in the form of androsterone.
8. In certain endocrine conditions, sex hormone findings appear consistently: high excretion in adrenal tumors; low excretion in pituitary disease; and severe damage to the genital and extra-genital sites of formation of male sex hormones in chronic cases of hypothyroidism and hyperthyroidism. In other endocrine conditions, such as in the undescended testicle and hirsutism, the findings are not uniform.
9. Various neurological diseases, such as epidemic encephalitis, Simmond's cachexia, diabetes insipidus and scleroderma show a diminution of hormones which demands further study.
10. Our findings in the major psychoses are still incomplete. There is no pathogenetic relationship between hormone excretion and involutional melancholia.
11. In children there is a gradual increase of androgens and estrogens according to age and general physical development, reaching in puberty a level even higher than that in the middle-aged adult. There is, however, no evidence of active sexual hormones in very young children, and there is nothing in their urine which can be compared to the typical findings in homosexuality or other types of sexual disturbance.

12. Ultraviolet irradiation is a physiological method of restoring a disturbed hormone balance and, therefore, may play a rôle in treatment of certain neuropsychiatric conditions.

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HUMAN BRAIN METABOLISM.

NORMAL VALUES AND VALUES IN CERTAIN CLINICAL STATES.*

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The development of a technique of sampling the blood of the internal jugular vein in man (Myerson, Halloran and Hirsch, 1927) has permitted studies of the metabolism of the human brain by analyses of the constituents of the blood entering the brain through the arterial system, and the blood leaving the brain through the internal jugular vein. A number of such studies have already been made on human subjects under various conditions. Lennox (1931) applied the method of internal jugular puncture to the study of the metabolism of the brain in a group of epileptic subjects; Damashek and Myerson (1935) used the same technique to investigate the effect of moderate doses of insulin on brain metabolism; Himwich, Bowman, Wortis and Fazekas (1939) reported the changes which occur during the hypoglycemic coma treatment of schizophrenia; and Himwich, Bowman, Goldfarb and Fazekas (1940) studied the effect of fever on the brain metabolism of parietic subjects. Williams and Lennox (1938) made similar studies on patients with arteriosclerosis, hypertension and increased intracranial pressure, using normal controls; and more recently Gibbs, Lennox and Gibbs (1940), using the same technique, have reported further results of their studies of the cerebral metabolism of epileptics.

The increasing interest in this method of investigation made it seem worthwhile to attempt to establish the normal range of variation of certain of the blood constituents entering and leaving the

* Read at the ninety-sixth annual meeting of The American Psychiatric Association, Cincinnati, Ohio, May 20-24, 1940.

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Aided by a grant from The Havelock Ellis Fund for Psychiatric Research.

brain, as well as the changes likely to occur in certain diseases or conditions. We have made a number of such observations, and the present report is a summary of the data recorded to date.

Method.—The venous blood leaving the brain was sampled from the internal jugular vein according to the technique described by Myerson *et al.* (1927). The arterial blood was obtained from the brachial, femoral or radial artery. The blood samples were drawn under mineral oil, delivered into glass tonometers over mercury, and kept in these vessels without contact with air until analyzed in the laboratory. Both samples of blood were usually obtained within two minutes. Coagulation was prevented by the addition of oxalate, and glycolysis was inhibited by the presence of fluoride. The blood was analyzed for oxygen, carbon dioxide (Van Slyke and Neill, 1924), glucose (Hagedorn and Jensen, 1923), and lactic acid (Friedemann, Cotonio and Shaffer, 1927). No direct determination of the brain blood flow was made in connection with these data, but peripheral blood flow was estimated from the cyanide circulation time (Robb and Weiss, 1932-3).

EXPERIMENTAL.

Normals.—Gibbs, Lennox and Gibbs (1940) report an average O_2 arterio-venous difference of the brain in 21 normal individuals of 6.4 volumes per cent. Since the significance of any findings in pathological conditions would necessarily be dependent on the values observed in normal individuals, we have also made observations on a group of essentially normal individuals. Though the patients were chosen from among those admitted to Bellevue Psychiatric Hospital, in all cases the final diagnosis was "no psychosis." These patients were considered to be normal in spite of histories of various problems of behavior or adjustment whenever their particular problems were clearly attributable to some situational factor and when there was no suggestion of any deep-seated psychiatric or physiologic disturbance on examination. The group thus included a miscellaneous number of patients recovered from mild reactive depressions, fully recovered cases of amnesia, behavior problems, discouraged unemployed individuals and the like. The average oxygen uptake in our group of experiments was 6.9 volumes per cent, a value only slightly higher than that reported by Gibbs, Lennox and Gibbs. The

arterio-venous difference for glucose averaged 9 mg. per cent, and the lactate exchange was 0. The circulation time was 15 seconds. The O_2 A-V differences in these 17 cases were added to the data reported by Gibbs, *et al.*, and are presented in Fig. 1.

Schizophrenia.—Fifty-three observations (not all of them, however, complete) were made on schizophrenic patients before any form of therapy was instituted. The results are presented in Fig. 1. It may be seen that the oxygen uptake averaged 6.7 volumes per cent, the glucose uptake was 10.0 mg. per cent, and the circulation time was 14 seconds. As far as one can determine from studies such as these, the metabolism of the brain in schizophrenia does not differ from that of the normal control group. Twelve observations on 8 patients after a course of at least 30 insulin shocks are also presented. The oxygen uptake of these cases averages 6.8 volumes per cent, the glucose uptake was 6 mg. per cent (based only on six completed observations), and the circulation time was 11.9 seconds. We call attention to the rise in CO_2 content of the internal jugular blood following a course of insulin treatment and the drop in glucose uptake. (See summary table.) Aside from these, the data show no significant difference from those observed before treatment. Moreover, no differences were found between those cases which responded and those which failed to respond to treatment, though our series of cases is still too small for any conclusive data on this point.

Cerebral Arteriosclerosis in Old Age.—The patients chosen for this portion of the study were senile male and female patients displaying in various degrees the forgetfulness and irritability characteristic of old age. Their age varied from 59 to 97 years. All cases showed the typical physical and mental changes associated with cerebral arteriosclerosis but no cases were included which showed a systolic pressure above 150 mm. Hg. or who had any other serious complicating disease. Though none of the cases was in heart failure, most of them showed the diminished cardiac reserve characteristic of their age group. The data in Fig. 2 reveal that the O_2 A-V difference in these cases averaged 6.68 volumes per cent, and the glucose A-V difference averaged 14.6 mg. per cent. It is noteworthy that this normal oxygen difference was maintained in spite of a definitely diminished arterial O_2 saturation. The cyanide circula-

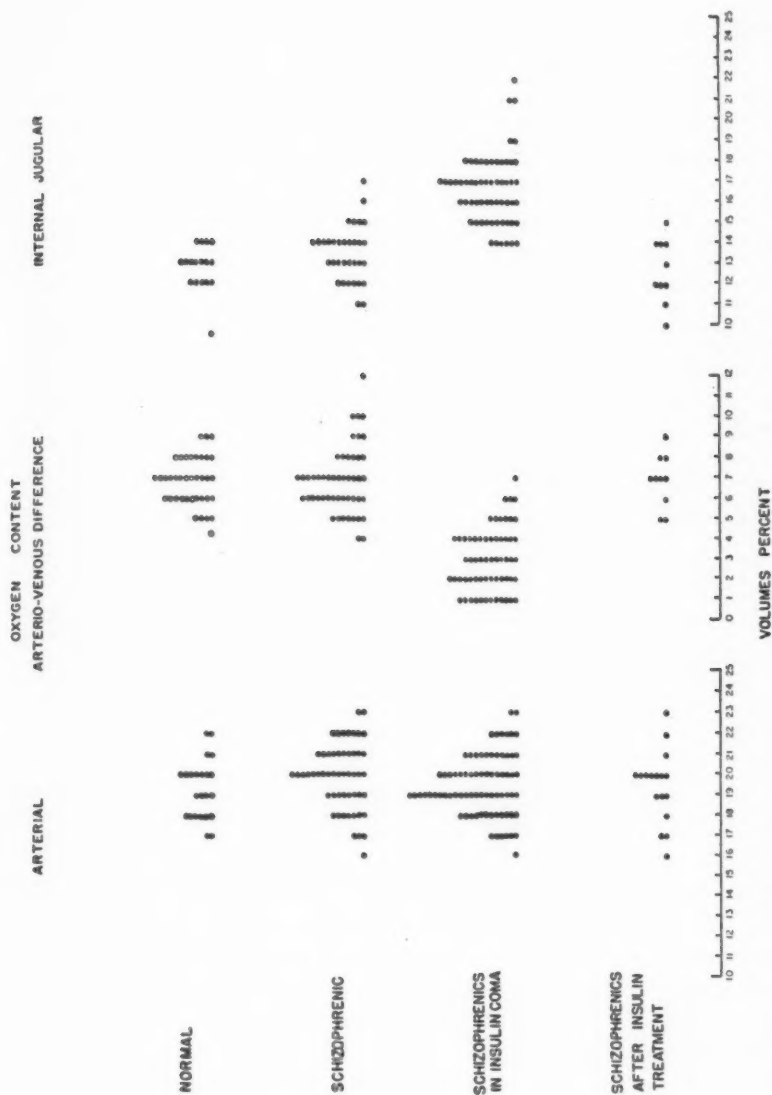


FIG. 1.—Cerebral Metabolism of Normal and Schizophrenic Patients. Data on Normal Subjects from the Report of Williams and Lennox Are Indicated by Circles.

tion time showed a slight increase to 16.6 seconds. The slower peripheral circulation associated with an unchanged oxygen uptake would indicate a somewhat reduced total metabolism of the brain in cerebral arteriosclerosis, such as might be expected in association with organic brain damage.

General Paresis.—In the course of an investigation of the effect of fever therapy on cerebral metabolism (Himwich, *et al.*, 1940) observations were made on a group of 18 patients with general paresis. The results are presented in Fig. 3. The average arterio-venous oxygen difference in this group of cases was 6.38 volumes

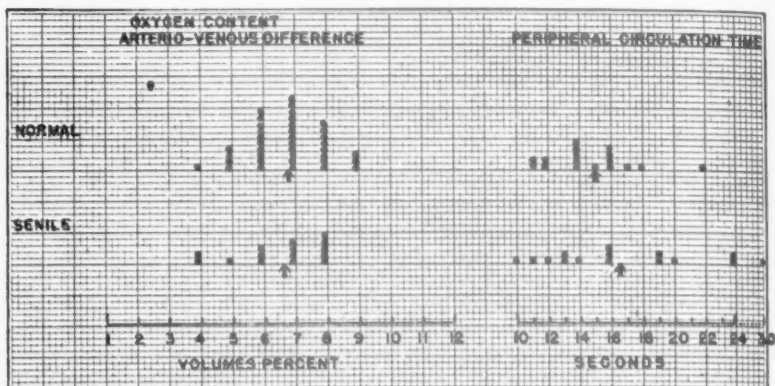


FIG. 2.—Cerebral Metabolism in Cerebral Arteriosclerosis. The Arrows Denote the Averages.

per cent, and the difference for glucose averaged 11 mg. per cent. The circulation time measured with the cyanide method was 15.0 seconds. These results did not differ significantly from the control group although the average O_2 arterio-venous difference is rather low.

Chronic Alcoholism.—The cerebral metabolism was estimated in a group of 52 chronic alcoholic patients. The study was made from 2 days to 4 weeks after admission of the patient, when there was no longer any significant amount of alcohol present in the blood. There was no clinical evidence of vitamin deficiency in these patients, and in most cases they were confined to the hospital for a long period because of fractures. The results are presented in Fig. 4. The average arterio-venous difference for this series of cases was 7.54 volumes per cent, for glucose 12.4 mg. per cent, and

the average circulation time was 13.7 seconds. Both the glucose and oxygen uptake in this series were significantly high. We have previously shown that the sugar tolerance of alcoholics is diminished on admission and only gradually returns to normal under regular hospital routine (Bowman, Wortis, Orenstein and Goldfarb, 1939). The average arterial glucose in this series of cases was 94 mg. per cent, which is significantly higher than the arterial

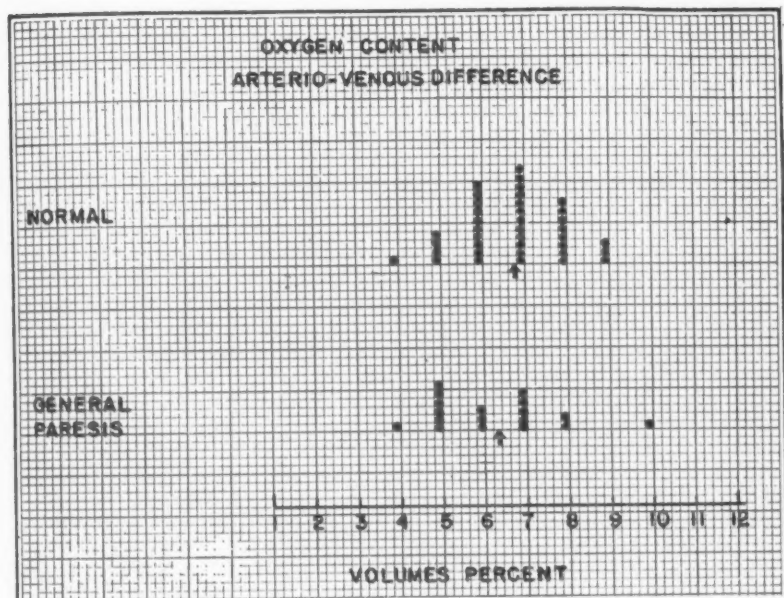


FIG. 3.—Cerebral Metabolism in General Paresis.

value in our normal controls. Since there seems to be a general correlation between brain metabolism and available glucose (Fig. 4) the apparently accelerated brain metabolism in chronic alcoholics may be related to this factor.

Acute Alcoholism.—We have already reported on the effect of alcohol on the cerebral metabolism of human subjects (Goldfarb, Bowman, Wortis, 1940). Using each patient as his own control we found that the arterio-venous difference for oxygen was diminished under the influence of alcohol. A similar conclusion may be drawn from the observations on 18 cases presented in Fig. 4.

It should be remarked that a number of the subjects were in alcoholic coma when the samples were taken. It may be concluded that a diminished oxygen uptake is characteristic of alcoholic intoxication. There also appears to be a definite lowering of both arterial and internal jugular CO_2 tensions, probably due to displacement

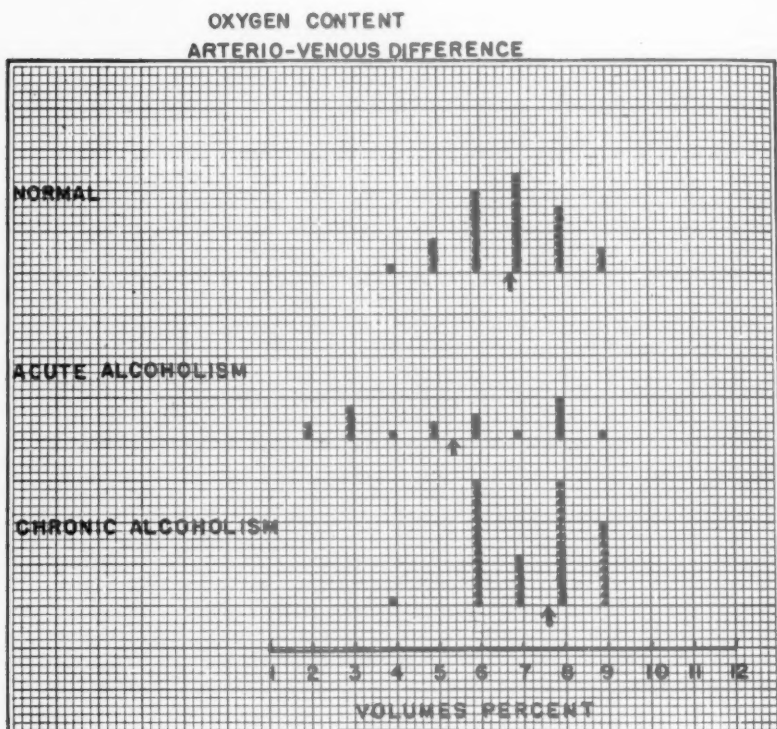


FIG. 4.—Cerebral Metabolism in Acute and Chronic Alcoholism.

of CO_2 by the increased lactic acid of the blood. The average glucose uptake was unchanged.

The Effect of Drugs: Paraldehyde.—The effect of paraldehyde on the metabolism of the brain was estimated in a group of 10 patients. The cerebral metabolism was estimated from the arterio-venous differences of oxygen, CO_2 , and glucose in the usual manner. Five drams of paraldehyde were then administered by mouth. At varying intervals a second estimation of the metabolism was made.

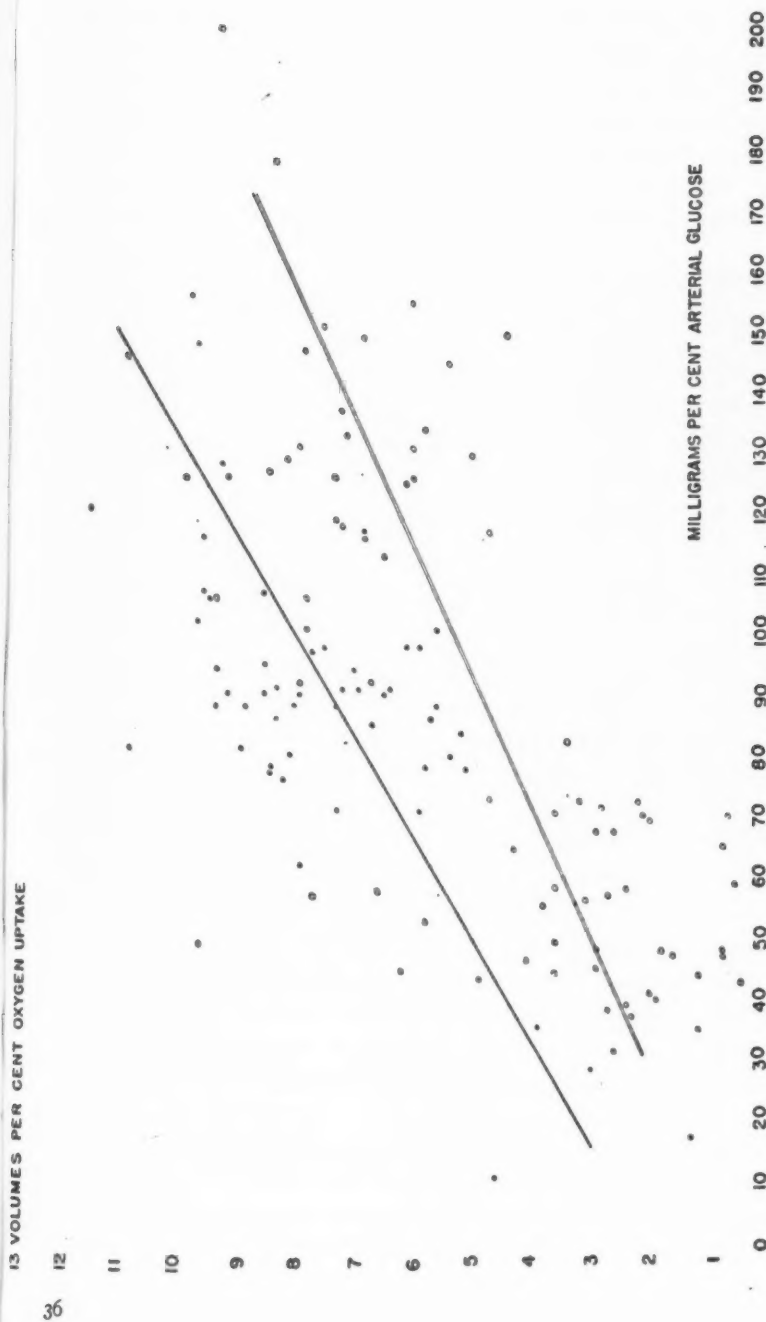
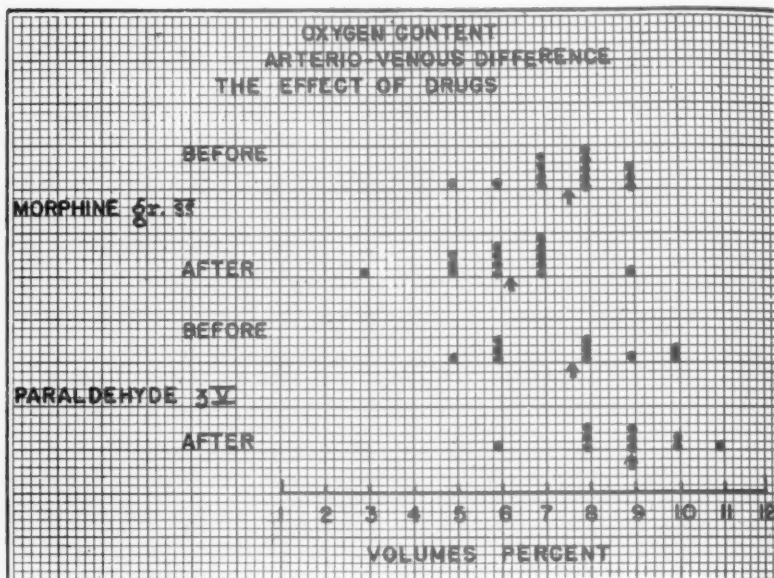


Fig. 5.—Correlation of Arterial Glucose and A-V Difference of Oxygen.

The solid line and dots represent Folin-Wu glucose determinations. The double line and circles are based on glucose determinations done by the method of Hagedorn-Jensen. Though there is considerable scattering, the lines closely approximate the averages for successive portions of the scale.

(Based on the groups of cases studied in this report in addition to a group of cases studied in insulin coma.)

The results are presented in Fig. 6. It may be seen that the average oxygen uptake increased from 7.6 to 8.9 volumes per cent, and the circulation time was increased from 12.4 to 14.3 seconds. Neither of these changes was statistically significant and since the increase of oxygen was counterbalanced by a slight decrease in the blood velocity it appears probable that therapeutic doses of paraldehyde do not affect the cerebral metabolic rate. It is noteworthy, however,



sis reveals that the change of oxygen uptake and the change of circulation time are both significant. It therefore appears probable that morphine diminished the metabolism of the brain. There was also an increased lactic acid uptake, which was not associated with an increased lactacidemia. The explanation for these changes is obscure. In all cases the half grain of morphine produced a marked sedative or soporific effect, though all of the patients could be easily roused from their sleep.

DISCUSSION.

Brain Metabolism.—The cerebral metabolism was estimated from the differences of the arterial and venous concentrations of various constituents of the blood. The method is subject to three sources of error: (1) the size of the brain in various patients; (2) the diffusion of the constituents from the blood to the brain tissue, or in the reverse direction; and (3) the cerebral blood flow.

It was impossible to make any estimate of the size of the brain. In those experiments in which various clinical groups were compared, it was regarded as an unknown variable. This factor, however, was eliminated in the experiments on the effects of drugs since each patient was used as his own control. The factor of diffusion of the constituents from the blood to the brain tissue or in the reverse direction was also an unknown variable in our experiments. However, in a large series of cases simple diffusion should be equal in both directions, and should not effect the validity of average values. Blood flow through the brain has been the principal unknown factor in the estimation of cerebral metabolism. Lennox and his coworkers by the use of the Gibbs thermostromuhr have been able to determine comparative blood flows in patients at different times. In the present experiments we have attempted to make some estimate of cerebral blood flow by determinations of the peripheral circulation time, though we are well aware that peripheral blood flow is only one of several factors effecting brain blood flow, and may under circumstances be compensated by changes in the calibre of the brain arterioles. Until direct determinations are made of actual brain blood flow, we recognize that certain of our conclusions remain tentative.

In a paper published in 1938 Williams and Lennox have raised another question relating to the interpretation of the results of this type of experiment. The authors have assumed that the metabolic rate of the brain in various groups of patients is a constant, and that "any significant differences in the average arterio-venous difference of oxygen or carbon dioxide content would thus be the results of a difference in total cerebral blood flow, high arterio-venous differences and high coefficients of utilization indicating diminished flow." Such an interpretation cannot be disproved by the present observations without absolute observations of the blood flow. However, in other conditions such an interpretation has been disproved. Damashek, *et al.* (1935), and Himwich, *et al.* (1939), have shown that the A-V O_2 difference is diminished during insulin coma. Interpreted in the fashion suggested by Williams and Lennox this would indicate a markedly increased blood flow, in some cases as much as 350 per cent. But direct observations of blood flow by Loman and Myerson (1936) under similar conditions actually indicate that the blood flow is diminished. Pending further experimental data, we have, therefore, preferred to regard the A-V O_2 difference as indicative of changes in the metabolism of the brain.

Lactic Acid Exchange.—We have elsewhere reported on the availability of lactic acid for human brain oxidations (Wortis, *et al.*), and found that the lactic acid could not support brain oxidations *in vivo*. With the exception of 2 groups of cases—alcoholics and those under the influence of morphine—arterio-venous difference for lactic acid did not exceed 3 mg. per cent. It is noteworthy that in all the groups here reported, with the single exception of the acutely alcoholic group, the average arterial lactic acid value remained close to 20. Patients under the influence of alcohol or morphine, however, showed an increased lactic acid uptake of the brain, 5 and 6 mgs. per cent respectively. Since the lactic acid content of the arterial blood was increased in the acutely alcoholic group, this increased lactic acid uptake may be due to diffusion, but the increased lactic acid uptake while under the influence of morphine occurs with normal arterial lactic acid values and was associated with a diminished glucose uptake.

The Respiratory Quotient of the Brain.—The average respiratory quotient of the brain remained close to unity in all the groups

CEREBRAL METABOLISM IN VARIOUS CONDITIONS.

Diagnosis.	No. of cases.	Oxygen, vol. %.				CO ₂ , vol. %.				Glucose, mg. %.				Lactic acid, mg. %.				Circulation time in seconds.
		A.	I. J.	D.		A.	I. J.	D.		A.	I. J.	D.		A.	I. J.	D.		
Normals	17-23	19.3	12.7	6.9		47.6	53.2	6.4		85	81	9		19	16	3		15
Schizophrenia before Rx.....	33-53	20.0	13.4	6.7		46.4	51.7	7.0		84	74	10		21	21	0		14
Schizophrenia after Rx.....	10-17	19.6	12.6	6.8		47.2	54.8	7.5		..	..	6*		..	..	..		12
Paresis	18	17.0	10.6	6.4		..	..	..		96	86	11		19	17	2		15
Cerebral arteriosclerosis	15	16.5	9.8	6.7		44.9	51.4	6.5		..	..	16		..	..	..		17
Chronic alcoholism	52	17.8	10.2	7.6		45.2	52.3	7.1		94	83	12		25	23	2		14
Acute alcoholism	19	18.0	12.6	5.4		43.0	48.0	5.0		..	..	13		39	34	5		12
Before paraldehyde	10	17.8	10.2	7.6		46.4	52.6	6.2		117	103	14		..	..	..		12
After paraldehyde	10	18.0	9.2	8.9		46.2	53.7	7.5		102	95	8		..	..	..		13
Before morphine	13	19.1	11.6	7.5		46.0	53.4	7.4		93	81	11		22	19	3		14
After morphine	13	18.5	12.2	6.2		48.5	53.4	4.9		87	83	5		20	14	6		16

* = 6 cases.

of cases studied. The total average for respiratory quotient of all the experiments here reported is 0.97. If we add to this 60 additional determinations made during other studies the grand average for determinations is 0.98. These results confirm the data on animals reported by Himwich and Nahum (1932) and those of Lennox (1931) on human subjects. There seems little room for doubt that carbohydrate thus comprises the chief if not the only foodstuff of the brain.

SUMMARY AND CONCLUSIONS.

The metabolism of the brain was studied in normal, schizophrenic, parietic and senile subjects, and the effect of alcohol, paraldehyde and morphine was studied. Arterio-venous differences for oxygen, carbon dioxide, glucose and lactic acid were determined by means of internal jugular puncture. The observations support the following conclusions:

1. The O_2 arterio-venous difference of the brain in schizophrenics, both before and after insulin therapy, is normal.
2. In general paresis the O_2 arterio-venous difference of the brain shows a slight diminution of questionable significance.
3. The O_2 arterio-venous difference of the brain in patients with cerebral arteriosclerosis is normal, but their systemic circulation is somewhat slow. This would indicate a reduced brain metabolism.
4. The O_2 arterio-venous difference in chronic alcoholism tends to be higher than normal and is associated with an elevated arterial glucose level.
5. Alcohol and morphine diminish the O_2 arterio-venous difference of the brain.
6. In therapeutic doses paraldehyde did not diminish the O_2 arterio-venous difference of the brain of chronic alcoholic patients.

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OXYGEN CONSUMPTION IN THE PSYCHOSES OF THE SENIUM.*

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We are reporting data concerning the consumption of oxygen by the brain in patients suffering from psychoses of the senium.

Recent work has shown that anoxemia may produce a wide range of behavioral changes in the human organism. Haldane (1919) reports that, during investigations on adaptation to reduced oxygen pressure, he found that marked emotional changes may occur. Similar changes, together with impairment of judgment, are reported by several other workers, among them Barcroft (1925). Extensive psychological investigations were carried out by McFarland (1937) on members of an expedition while at sea level, at 12,020 feet, at 15,440 feet, at 17,500 feet and at 20,140 feet. He found that the tendency to perseverate was definitely increased, that there was marked impairment of recent memory, and increased difficulty in concentration. These disabilities became progressively more marked as the expedition ascended.

It is interesting to note that in myxedema, where the oxygen consumption is also diminished, impoverishment of recent memory and confusion are regularly reported (Bleuler, 1930; Henderson and Gillespie, 1937; and Noyes, 1939).

With regard to oxygen utilization during the senium, data are already available concerning the basal metabolic rate, adaptation to exercise, oxygen consumption of certain tissues in vitro, cardiac output and blood circulation time. Kisé and Ochi (1934) have reported a progressive drop in oxygen consumption in old age in Japanese subjects. For men in the 50-59 year range the caloric production per square meter per hour was 36.05, as contrasted with 32.06 for those over 82. Lewis (1938) examined normal

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men in each decade from 40 to 89, and reports a negative correlation of 0.3328 ± 0.0889 between age and heat production. Benedict (1935) has published a prediction table for the basal heat production of elderly Caucasian women per square meter of body surface. The value at 66 years is 32.0 calories and, at 88, 28.5 calories.

While it is difficult to state in the light of available data whether the decreased heat production in old age is due to partial oxygen starvation or to decreased need, it can be stated definitely that the aged organism cannot efficiently meet an increased demand for oxygen by the tissues. Robinson (1938) has shown that the hearts of aged men respond less adequately than do those of younger men to exercise on a treadmill. He has also shown that, after exercise on the treadmill, the amount of lactic acid was 3.5 times as great at 60 years as at 20. Mori (1936) has demonstrated that after exercise the alkaline reserve in boys in their teens dropped by 4 vol. per cent CO_2 , and in persons in their sixth decade by 12 vol. per cent. Robinson (1938) has reported that the pressure gradients of O_2 and CO_2 in the exchange of gases in the lungs increase with advancing age. He suggests that may be indicative of impairment of diffusion of gases through the capillary and alveolar walls in aged persons.

With regard to the oxidation rate of individual tissues with respect to age, Cohen (1939) has reported experiments on heart and lung preparations in dogs. He found that "as the animals grow older, their hearts, per gram of heart muscle, consume less oxygen to a significant degree."

Pearce (1936) has found that the oxygen consumption of exercised liver, kidney and resting ventricular cardiac musculature of a genetically pure strain of mice was less at the 50-60 weeks age level than at the 4-9 weeks age level. The percentage decreases were: liver, 34.8; cardiac muscle, 28.0; kidney, 11.5.

With regard to the cardiac output, Grollman (1932) states, "It is probable that the cardiac index decreases from about 2.5 litres per minute per square meter surface area in children to 2.2 in young adults to 2.0 in older normal individuals."

Gottlieb (1939) has reported the mean circulation time for 11 patients with slight arteriosclerosis was 24.4 seconds. This contrasts with the normal arm to carotid circulation times as reported

by Robb and Weiss (1933) 15.6, Gargill (1932) 15.6, Cohen and Thompson (1936) 15.7, and Freeman, H. (1934, 1938) 21.9 seconds and 19.1 seconds.

The similarity between the behavioral changes produced by chronic oxygen want is found in high altitudes or lower barometric pressures and chronic interference with oxidation, as in myxedema on the one hand and certain of the behavioral changes associated with the senium on the other, is sufficiently striking to call for further investigation, especially in view of the evidence available concerning the reduced oxygen consumption during the latter decades of life.

PROCEDURE.

The clinical material consisted of a group of 23 patients suffering from psychoses occurring within the senium. The age range was 60 to 87 years and the group contained 8 women. The symptoms shown were those characteristic of psychoses occurring during this period of life—confusion, disorientation, loss of recent memory, emotional instability, delusional notions, habit deterioration and poor judgment.

Blood was taken from the internal jugular vein and femoral artery while the patient was in a fasting basal condition. In addition, the arm to carotid circulation time was estimated in 13 of these patients on two separate days by means of the sodium cyanide method (Freeman, 1938). The red cell count and hemoglobin content of the blood (Sahli) were obtained.

RESULTS.

In the blood gas findings the hemoglobin and red cell counts and circulation times are recorded in Table I. It will be noted that the average arterial oxygen is definitely lower than the normal. If those cases in which the hemoglobin was above 90 per cent and the red cell count was 4,000,000 or above are taken alone, it is found that the average arterial oxygen for this group is 17.12 vol. per cent, indicating that in part the low arterial oxygen is due to the reduced oxygen-carrying capacity of the blood.

The arm to carotid circulation time of the blood was definitely lengthened. Even if those cases are included in which completely basal conditions could not be obtained because of the emotional

instability of the patient, the A-V difference of the whole group is close to normal. It is of interest to note, however, that the average A-V difference for those patients on whom circulation times were obtained is also approximately normal, namely, 6.79 vol. per cent, and that in the patients in whom the A-V difference is markedly increased, *e. g.*, Cases 15, 17 and 23, the circulation

TABLE I.

Case.	Age.	Art. O ₂ (vols. %).	A-V diff. (vols. %).	Circ. time (in seconds).	R. B. C. (in millions).	Hgb. (Sahli) %
1	66	15.41	5.77	.....	6.60	95
2	73	15.56	7.46	.....	4.07	98
3	81	12.89	6.87	.....	3.30	72
4	80	13.98	5.35	.....	3.30	73
5	62	17.45	9.25	.....	3.45	73
6	73	17.46	7.95	.....	4.26	102
7	60	17.70	5.86	.....	4.38	84
8	77	17.93	8.34	.....	5.00	100
9	70	17.11	6.47	.....	4.74	97
10	82	13.47	8.20	.....	...	70
11	73	19.38	5.76	17.3*, 17.3*	5.00	94
12	67	16.57	4.87	16.8*, 16.8*	5.00	92
13	67	18.30	6.10	29.8, 29.8	4.50	100
14	68	18.13	6.75	28.2, 28.0	3.10	84
15	82	15.13	9.30	28.0, 31.8	4.10	90
16	87	11.89	5.05	20.5, 24.7	3.20	67
17	76	17.62	7.28	36.8, 28.1	4.50	93
18	73	14.90	5.19	24.6, 28.0	2.77	70
19	74	14.64	5.18	20.0*, 14.0*	4.03	90
20	64	17.19	...	22.6, 22.0	4.70	88
21	80	19.40	7.30	25.6, 20.0	4.00	90
22	70	15.60	5.71	26.2, 27.8	4.00	82
23	68	17.45	9.30	35.0, 45.6	4.91	98
Average	73	16.31	6.79	25.6	4.22	87

* Patient disturbed.

time is also above average. This is in accord with the assumption that blood which is longer in transit through the cerebral tissues gives up more of its oxygen. The red cells and hemoglobin count are both somewhat below normal.

DISCUSSION.

The results suggest that cerebral oxygen consumption is interfered with in this group of patients at several points. The de-

creased arterial oxygen content found even in those patients in whom red cell and hemoglobin counts are within normal ranges tends to support the contention that it may be explained at least in part by the emphysema which tends to appear in aged persons and which results in an increase of the residual air. As a possible further explanation, the suggestion of Robinson (1938) that there is an impairment of gaseous diffusion through the capillary and alveolar walls in aged persons must be borne in mind. The average red cell count and hemoglobin percentage indicate that there is some reduction in the oxygen-carrying power of this group of patients. The hemoglobin findings are in accordance with the claims of Williamson and Etts (1926) that there is a gradual loss of hemoglobin after the age of 60, *i.e.*, a degree of anemia. With respect to the erythrocyte count, McCay (1939) in reviewing the literature feels that there is still too much disagreement in results to permit a final statement as to the effects of ageing on the red cell count.

The average circulation time is definitely increased. If those patients in whom some emotional upset was present were eliminated, the average would be still further raised. The present average is about 2 seconds longer than that reported by Gottlieb (1939). This difference may rest upon the fact that his cases showed only slight arteriosclerosis, while in several of ours this condition was advanced.

In view of this slowing of the circulation time and in view of the apparent tendency for the A-V difference to increase with increased circulation time, the fact that the average A-V difference for this group was found to be within normal limits is of considerable interest. It suggests that in these cases the capacity of the cerebral tissues to take up oxygen is reduced. If it were not, it seems reasonable to anticipate that, in consequence of the increased circulation time, more oxygen would be taken from the blood passing through the cerebrum, and the A-V difference thereby increased. This suggested reduction in the cerebral oxidation rate is in accord with the *in vitro* findings of Pearce who states that the oxygen consumption of liver, kidney and heart muscle excised from aged animals is definitely reduced, and also by the findings of Cohen, which indicate that the heart muscles of aged dogs consume significantly less oxygen.

SUMMARY.

1. Twenty-three patients suffering from psychoses occurring within the senium were investigated with regard to their cerebral oxygen consumption.

2. The arterial oxygen was low (16.31 vol. per cent). It is suggested that this is in part due to the emphysema and increase in residual air frequently found in aged persons; it may be due in part to failure of diffusion from the capillary alveolar walls.

3. The oxygen-carrying power of the blood was reduced, as indicated by an erythrocyte count of 4,220,000 and a hemoglobin of 87 per cent (Sahli).

4. The arm to carotid circulation time was increased (25.6 seconds).

5. If the cerebral circulation time is reduced, as we have shown the arm to carotid circulation time to be, then the normal cerebral A-V difference in our patients would indicate a diminished oxygen consumption by the cerebral tissues.

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THE CLINICAL SIGNIFICANCE OF BISULFITE
BINDING SUBSTANCES (B.B.S.) IN THE
BLOOD AND CEREBROSPINAL FLUID.*

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Evidence is accumulating that vitamin B₁ is concerned with carbohydrate metabolism in the living organism. As regards the central nervous system, Banga, Ochoa and Peters¹ have shown that the diphosphoric ester of vitamin B₁ (cocarboxylase) is necessary for the normal catabolism of pyruvic acid—one of the normal intermediary products of carbohydrate metabolism. Since the brain depends almost entirely on carbohydrate for its normal functioning, the importance of vitamin B₁ in nerve tissue metabolism is emphasized.

Brain tissue from pigeons showing acute opisthotonic symptoms (vitamin B₁ deficient) takes up less O₂ in the presence of added lactate or pyruvate than does normal tissue respiring in the presence of the same substrate. The addition of vitamin B₁ in vitro largely restores the O₂ uptake to normal, increasing the disappearance of pyruvate but not of lactate. Peters² concludes that the acute nervous symptoms of vitamin B₁ deficiency are related to the absence of an important factor (cocarboxylase) in the development of energy from carbohydrate. In the absence of this substance, the breakdown of carbohydrate to carbon dioxide and water does not proceed normally, and pyruvic acid accumulates in the body fluids.³ Similar effects, although much less marked and less easily demonstrated, were observed by O'Brien and Peters⁴ in avitaminotic B₁ rat brains.

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This work was aided by a grant from Child Neurology Research (Friedsam Foundation).

In respiration studies on brain and other tissues from polyneuritic chicks, Sherman and Elvehjem⁵ observed anomalies of pyruvate metabolism similar to those described in pigeon brain. Polyneuritic chicks also showed a diminished pyruvate tolerance *in vivo* as evidenced by the less rapid removal from the blood and the increased excretion of bisulfite binding substances (B.B.S.) following the injection of pyruvate.⁶ Thompson and Johnson⁷ noted an increase in the blood B.B.S. of vitamin B₁ deficient pigeons, and Johnson⁸ felt that this accumulation was primarily due to an increase in pyruvic acid.

Pyruvic acid, in common with other keto acids, and in fact all aldehydes and ketones, possesses the ability to bind bisulfite. Investigators have therefore used the measurement of the bisulfite binding power of blood as a rough indicator of the pyruvic acid level of that sample.* Furthermore, Platt and Lu³ demonstrated that the B.B.S. of the blood was increased in cases of oriental beri-beri, a disease which shows a very rapid and dramatic response to vitamin B₁ therapy. They felt that this increase was due largely to an accumulation of pyruvic acid in the tissues. They also state that the cerebrospinal fluid in these cases showed an increase in carbonyl compounds, but they do not give any normal figures for comparison. Following Platt and Lu, Wilson and Ghosh¹⁰ stated that the blood B.B.S. was increased in epidemic dropsy (India), anemia, splenomegaly and diabetes, but admitted that the substances involved in this increase were not definitely known. Wilkins, Taylor and Weiss¹¹ reported estimations of blood B.B.S. on 174 patients. They however noted increases in conditions other than vitamin B₁ deficiency. Their study indicates that substances other than pyruvic acid contribute to the values obtained. Furthermore, Jong¹² found no correlation between the B.B.S. of the blood of polyneuritic pigeons and the clinical symptomatology.

The bisulfite binding substances (total aldehydes and ketones) have thus been the subject of much recent investigation, and their relationship to vitamin B₁ deficiency has been both confirmed and denied.

* Two of us (E. B. and H. W.)⁹ have published a method for the estimation of pyruvic acid. We are at present attempting to determine its specificity as regards vitamin B₁ deficiency.

The present study of B.B.S. in the blood and spinal fluid was undertaken in order (1) to compare the levels of bisulfite binding substances in the blood and cerebrospinal fluid, (2) to study the level of bisulfite binding substances in the blood and cerebrospinal fluid in various neuropsychiatric and medical disorders, (3) to determine the relationship of any increase in these carbonyl compounds (B.B.S.) to clinical evidences of vitamin B₁ deficiency.

METHOD.

Blood and spinal fluid were taken from patients fasting and at rest and delivered into bottles containing dried potassium oxalate. In almost every case duplicate samples were analyzed without delay. The following modification of the method of Clift and Cook¹³ was used.

Ten mls. of oxalated blood (or spinal fluid) is precipitated immediately with 40 mls. of 10 per cent trichloroacetic acid, allowed to stand for 30 minutes and then filtered. Thirty mls. of the blood filtrate and 40 mls. of the spinal fluid filtrate are adjusted to p.H₂ by the addition of 10 per cent NaOH. To this mixture is added 1 ml. of molar sodium bisulfite solution and the sample allowed to stand for 15 minutes. Five drops of a freshly prepared 1 per cent starch solution are then added and the excess bisulfite titrated against N/10 iodine solution. The end point is adjusted with N/200 iodine and N/200 sodium thiosulfate solutions and fixed to a one drop iodine excess. The bound bisulfite is now released by supersaturation with dry sodium bicarbonate salt and the released bisulfite then titrated immediately with an excess of N/200 I₂ solution. This excess is readjusted by titration with N/200 thiosulfate. The addition of an excess of I₂ prevents the volatilization and loss of liberated bisulfite. Throughout the titration procedure, the flask is rotated in a medium of cracked ice.

A reagent blank is titrated on each occasion.

CALCULATION.

The amount of N/200 I₂ corresponding to the liberated bisulfite is equivalent to the total I₂ minus the thiosulfate. The value of the blank is then deducted from this figure. This difference is then multiplied by 3.68 for the blood sample and 2.75 for the spinal

fluid sample. The result obtained equals the total B.B.S. expressed as mgms. of pyruvic acid per 100 mls.

B.B.S. IN THE BLOOD AND CEREBROSPINAL FLUID.

Simultaneous samples of blood and cerebrospinal fluid were obtained on 128 patients with various neuropsychiatric and medical disorders. Wilkins and his co-workers,¹¹ using a similar technique, reported the average range for blood at 3.66-5.75 mgms. per cent with an average of 4.74 mgms. per 100 ml. Platt and Lu³ working in the Orient, had previously reported as normal 2.22-4.82 mgms.

CHART I.

Group.	Blood range B.B.S., mgms. %.	Cerebrospinal fluid Range B.B.S., mgms. %.	C.S.F. Blood range, %.	No. of Cases.
I.	5.93-19.4 (Av. 8.13)	1.02-27.8 (Av. 4.82)	25-140 (Av. 59)	22
II.	5.03-5.72 (Av. 5.59)	1.32-4.27 (Av. 2.02)	25-81 (Av. 53)	99
III.	3.70-4.98 (Av. 4.26)	1.01-3.07 (Av. 1.81)	25-77 (Av. 42)	51
IV.	2.00-3.63 (Av. 3.13)	0.42-2.36 (Av. 1.37)	21-74 (Av. 45)	46
Total				128

per cent. Since our own control cases (50) fall within the range set up by Wilkins and his co-workers, it was decided to use 5.75 mgms. per cent as the upper limit of normal. For purposes of analysis our cases are divided into four groups, dependent upon the blood level. Those patients with blood levels above 5.75 mgms. per cent were considered abnormally high. (See Chart I.)

Of these cases 106 had normal ranges for B.B.S. in the blood (2.00-5.72). Their spinal fluid figures ranged from 0.42-4.27 with an average of 1.66 mgms. per cent. Only five cases were in the range of 0.42-1.00 mgms. per cent, and most of the cases above 2.25 were inebriates or diabetics with definite indications of disturbances in vitamin and carbohydrate metabolism. It is therefore our belief that the normal range for B.B.S. in the spinal

fluid ranges from about 1.00-2.25 mgms. per cent and that the spinal fluid ordinarily contains 35-60 per cent the amount of B.B.S. present in a corresponding blood sample. Children apparently had somewhat lower figures in blood and cerebrospinal fluid than adults, but the results were well within the normal range.

CLINICAL STUDIES

The material presented consisted of 222 cases from the wards at the Bellevue Psychiatric Hospital. They formed the following diagnostically labelled groups:

GROUP 1.

ALCOHOLISM (TOTAL 19 CASES).

	Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1.	K. M.	38	Tremulous	13.5	3.67	27
2.	H. C.	51	Chronic alcoholism; fatty liver; old peripheral neuropathy; acetonuria	7.02	1.05	13
3.	S. W.	67	Generalized arteriosclerosis	6.16	3.56	55
4.	D. H.	42	.....	5.35	1.64	30
5.	D.	44	Acute peripheral neuropathy....	5.12	2.64	52
6.	D. P.	46	Periportal fibrosis; fatty infiltration	4.85	2.18	45
7.	G. C.	48	.....	4.55	1.45	32
8.	G. L.	45	.....	4.12	1.47	36
9.	N. W.	38	Fatty liver; pellagrous dermatitis; nicotinic acid therapy...	3.71	1.68	45
10.	L. A.	53	Acute peripheral neuropathy...	3.70	1.91	52

It will be noted that three of the ten cases had abnormally high figures in the blood and that in two of these the spinal fluid was also elevated. Case 2 (H.C.) had acetone in her urine which probably accounted, at least in part, for the increased B.B.S. Of the seven normal cases, two had acute peripheral neuropathy. This syndrome in alcoholics is now definitely known to be a vitamin B₁ deficiency.¹⁴ The finding of normal values in the presence of this clinical syndrome definitely indicates that normal B.B.S. values may exist in the presence of clinical vitamin B₁ deficiency.

It has already been stated that the specific biological lesion in vitamin B₁ deficiency is an inability of the body to completely oxidize pyruvic acid, resulting in its accumulation in the body tissues and fluids. Earlier investigators felt that the elevated B.B.S. indicated an increase in pyruvic acid. Our as yet unpublished studies indicate that an increase in pyruvic acid is not necessarily reflected in the total B.B.S. We have, for example, seen several cases of acute peripheral neuropathy in which the pyruvic acid levels were elevated, but the total B.B.S. was normal. Pyruvic acid, which is a keto acid, definitely contributes to the total B.B.S., but there may be many other factors in any individual case. It is therefore certain that if the B.B.S. determinations are to mean anything, each factor contributing to the total B.B.S. must be individually analyzed.

Studies on the blood alone were made on nine additional inebriates. Eight had normal figures ranging from 2.84-4.88 mgms. per cent. In one instance the B.B.S. for the blood was elevated to 13.4 mgms. per cent, but this patient showed evidence of marked acidosis with a 4 plus acetonuria. This high figure is explained, at least in part, by the fact that acetone itself possesses the power to bind bisulfite. The pyruvic acid in this particular case (determined by the method of Bueding and Wortis⁹) was normal. This again indicates that the total B.B.S. cannot be used for the determination of pyruvic acid in every instance.

Early in our study it was observed that many alcoholics who had received paraldehyde showed exaggerated values for B.B.S. in the blood and cerebrospinal fluid. Taylor, Weiss and Wilkins¹⁵ noted that in three of their alcoholic cases the administration of large doses of this drug was followed by a slight rise in the blood B.B.S. They remarked, however, that several other patients, after equally large amounts of this drug, showed no change in the blood B.B.S., but they made no mention of the time interval after administration that these determinations were done. Our studies indicated that while paraldehyde itself does not bind bisulfite, the method employed in making these determinations probably causes a partial hydrolysis of paraldehyde to acetaldehyde, which latter binds bisulfite. Three inebriates who had recovered from an acute alcoholic bout were given paraldehyde, drams IV, by mouth and

the blood B.B.S. were determined at intervals for the next 24 hours. The results are shown in Chart III.

CHART II.

ALCOHOLISM WITH PARALDEHYDE THERAPY (TOTAL 13 CASES).

Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1. S.	50	Tremulous alcoholic. Paraldehyde four hours ago.....	11.7	7.42	65
2. J. A.	40	Tremulous alcoholic. Paraldehyde 12 hours ago.....	10.5	7.13	68
3. L. W.	48	Paraldehyde 12 hours ago.....	8.35	2.18	26
4. K. M.	45	Hallucinosi s	7.32	4.40	60
5. M. J.	46	Hallucinosi s; hypomani c. Paraldehyde 12 hours ago.....	6.53	3.04	47
6. C. E.	27	Hallucinosi s. Paraldehyde 12 hours ago	6.04	2.60	43
7. B. J.	44	Delirium tremens. Paraldehyde 12 hours ago.....	5.93	4.66	79
.....					
8. D. M.	43	Hallucinosi s. Paraldehyde 24 hours ago	4.61	2.78	60
9. E. S.	57	Acute alcoholism, B. and C. four hours ago. Paraldehyde 12 hours ago	4.26	2.10	49
10. S. M.	35	Paraldehyde 24 hours ago.....	3.12	1.44	46

CHART III.

EFFECT OF PARALDEHYDE ON BLOOD B.B.S.

Patient.	Age.	Before paraldehyde Blood B.B.S., mgms. %.	2½ hours after paraldehyde. Blood B.B.S., mgms. %.	7½ hours after paraldehyde. Blood B.B.S., mgms. %.	24 hours after paraldehyde. Blood B.B.S., mgms. %.
M	40	3.76	7.10	...	3.59
P	28	4.53	9.96	...	4.61
H	37	3.51	6.82	5.58	3.66

It must therefore be emphasized that B.B.S. readings in patients who have received paraldehyde within the past 24 hours must be evaluated with caution.

Three of the four cases with elevated B.B.S. had evidences of peripheral neuropathy, but one of the cases with normal figures also had peripheral neuropathy. This again indicates that the

blood and spinal fluid B.B.S. levels cannot be used as evidences of vitamin B₁ deficiency. It may of course be that in some cases the metabolic defect has led to irreversible pathological changes, so that even when the metabolic defect is corrected, the pathological changes persist. This, however, remains a subject for future study.

CHART IV.

DELIRIUM TREMENS (TOTAL 7 CASES).

	Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1.	T. H.	50	Convulsions; old peripheral neuropathy	7.42	2.08	28
2.	S. T.	47	Old peripheral neuropathy.....	6.30	4.11	65
3.	T. R.	28	Uncomplicated	6.28	8.68	38
4.	V. L.	56	Peripheral neuropathy; died next day	6.10	2.96	48
5.	G.	58	Old peripheral neuropathy.....	4.95	2.68	54
6.	C. A.	57	Cellulitis; T. 105° F.....	4.67	2.08	45
7.	M. W.	40	Korsakoff features; B. and C. 5 hours ago.....	4.29	3.07	72

CHART V.

ALCOHOLIC HALLUCINOSIS (TOTAL 4 CASES).

	Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1.	S. S.	46	.....	4.86	1.91	35
2.	F. F.	51	Almost cleared	4.28	1.54	36
3.	F. F.	51	Cleared	4.21	1.83	44
4.	B. E.	51	.....	3.84	2.65	77

The figures in all four cases were normal.

CHART VI.

WERNICKE'S SYNDROME (TOTAL 4 CASES).

	Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1.	M. D.		Acute peripheral neuropathy...	7.85	2.75	29
2.	K. S.	51	Old peripheral neuropathy.....	4.55	2.96	65
3.	D. T.	61	General arteriosclerosis	2.92	1.31	45
4.	R. J.	56	General arteriosclerosis	2.89	1.20	42

One case had an elevated B.B.S. in the blood. In this instance peripheral neuropathy was present. Here again, however, one patient with a normal B.B.S. in the blood and a border-line figure in the spinal fluid had peripheral neuropathy. (K.S.)

CHART VII.

KORSAKOFF SYNDROME (TOTAL 2 CASES).

Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1. M. W.	34	Arteriosclerosis; anginal syn- drome	4.93	2.42	49
2. A. H.	38	Cleared	2.64	1.33	50

Both these patients had normal figures.

CHART VIII.

CENTRAL NERVOUS SYSTEM SYPHILIS (TOTAL 13 CASES).

Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1. S. E.	32	General paresis	8.06	5.16	64
2. S. P.	66	General paresis	7.63	2.65	34
3. G. G.	36	Psychosis with C.N.S. lues.....	6.06	1.87	31
4. S. W.	54	Psychosis with C.N.S. lues.....	5.07	2.67	52
5. M. E.	15	Congenital cerebral lues; con- duct disturbance	4.42	1.27	29
6. S. R.	45	Psychosis with C.N.S. lues.....	4.29	1.07	25
7. K. G.	40	General paresis	4.12	1.88	45
8. L. J.	42	General paresis	4.08	1.43	35
9. B. A.	48	General paresis	3.76	1.10	29
10. C. J.	50	General paresis	3.76	1.31	35
11. C. G.	48	General paresis	3.46	1.68	49
12. M. T.	40	Lues; alcoholism; heroin addic- tion	3.44	1.41	41

Three of these patients had elevated B.B.S. in the blood and one of these three had a definite elevation of the B.B.S. in the cerebrospinal fluid. Both had had sodium amytal. The effect of sodium amytal on the B.B.S. level is now being investigated. Nine similar cases showed no elevation of the B.B.S. in either the blood or the

cerebrospinal fluid. In one additional case of general paresis the blood B.B.S. level was normal (3.57 mgms. per cent).

CHART IX.

SCHIZOPHRENIA—ALL TYPES (TOTAL 31 CASES).

	Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1.	S. M.	23	Catatonic schizophrenia; 2 day starvation	9.90	4.34	49
2.	K. J.	39	Catatonic schizophrenia; Na amytal 48 hours ago.	6.73	1.75	25
3.	H. H.	39	Paranoid schizophrenia	6.15	2.20	36
4.	C. E.	15	Paranoid schizophernia	5.68	1.44	25
.....						
5.	T. B.	22	Schizophrenia	5.02	1.80	36
6.	F. A.	33	Paranoid schizophrenia	4.53	1.37	30
7.	C. A.	16	Schizophrenia	4.56	1.64	36
8.	B. W.	29	Paranoid schizophrenia	4.40	1.23	28
9.	R. C.	32	Paranoid schizophrenia; alco- holism, cleared	4.24	1.64	39
10.	B. N.	18	Catatonic schizophrenia	4.21	1.38	33
11.	F. J.	22	Hebephrenic schizophrenia	4.17	1.39	34
12.	K. D.	33	Schizophrenia	4.16	1.70	41
13.	K. J.	47	Schizophrenia	4.01	1.01	25
14.	C. J.	24	Schizophrenia	3.54	1.11	32
15.	R. E.	18	Schizophrenia	3.54	1.46	41
16.	B. E.	12	Schizophrenia; frightened dur- ing procedure	3.46	1.58	45
17.	W. R.	32	Schizophrenia	3.44	1.00	28
18.	F. M.	42	Paranoid schizophrenia. Blood Wassermann 4 plus.	3.31	1.49	45
19.	B. T.	36	Schizophrenia	3.26	1.04	32
20.	S. M.	35	Schizophrenia	3.20	1.37	43
21.	L. J.	47	Paranoid schizophrenic; chronic alcoholism	3.12	1.81	58
22.	D. M.	33	Schizophrenic	3.12	1.81	58
23.	S. W.	14	Hebephrenic schizophrenia	3.12	1.48	47
24.	R. M.	40	Paranoid schizophrenia	2.73	2.03	74
25.	C. P.	33	Hebephrenic schizophrenia	2.42	1.24	51

Three of the 25 cases had an elevated blood B.B.S. and in one of these the spinal fluid, too, showed elevated figures. In two of the three cases with elevated blood B.B.S. the patient had received sodium amytal. Twenty-two similar cases showed no elevation of

the B.B.S. in either blood or spinal fluid. In six additional cases of schizophrenia, blood studies alone were done. Here again there was no deviation from the normal range, the lowest being 3.16 and the highest 4.08 mgms. per cent. Interestingly, Chase¹⁶ attempted to augment the oxidative processes in 10 cases of schizophrenia with vitamin B₁. He could see no change in the clinical picture.

CHART X.

MANIC DEPRESSIVE PSYCHOSIS (TOTAL 4 CASES).

Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1. H. S.	36	Manic-depressive; depressed; fifth attack	4.38	1.68	38
2. P. W.	33	Manic-depressive; depressed ...	3.82	1.60	37
3. K. L.	55	Manic-depressive; depressed ...	3.07	1.37	44
4. M. M.	12	Manic-depressive; manic	2.77	1.53	55

These patients all had normal figures in the blood and cerebro-spinal fluid.

CHART XI.

MISCELLANEOUS PSYCHOSES AND NEUROSES (TOTAL 22 CASES).

Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1. J. J.	45	Psychosis with organic brain disease	5.72	2.09	37
2. C. J.	45	Psychosis with Cerebral arterio- sclerosis	5.51	2.56	46
3. Z. J.	54	Psychosis with hypertension....	5.07	1.32	26
4. G. L.	39	Psychosis with epilepsy; rest- less; luminal cleared.....	4.42	1.72	39
5. R. S.	55	Psychosis with cerebral-arterio- sclerosis	4.40	1.18	27
6. C. G.	12	Psychoneurotic anxiety state...	3.81	1.16	38
7. L. S.	51	Involuntional melancholia, para- noid Na amytal.....	3.76	2.00	53
8. J. G.	59	Psychosis with hypertension....	3.59	1.78	50
9. B. T.	14	Conversion hysteria	3.41	1.04	34
10. R. E.	30	Postepileptic confusion; epilep- tic deterioration	3.31	1.10	33
11. C. J.	70	General and cerebral arterio- sclerosis	3.30	2.36	72

All the patients in Chart XI had normal figures in the blood and cerebrospinal fluid. Case 7 (L.S.) had received sodium amytal.

Four additional cases of psychosis with psychopathic personality had normal figures in the blood alone (3.01-4.66 mgms. per cent). Four cases of psychoneurosis similarly yielded normal figures in the blood (3.03-4.25 mgms. per cent). Two additional cases of psychosis with cerebral arteriosclerosis had normal figures (3.74 and 4.93 mgms. per cent) and one case of psychosis with epidemic encephalitis had a normal blood figure (2.80 mgms. per cent).

CHART XII.

MISCELLANEOUS MEDICAL CONDITIONS (TOTAL 10 CASES).

Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1. A. G.	40	Diabetes mellitus. 4 plus sugar and 4 plus acetone in urine...	19.4	27.8	1.40
2. N. J.	45	Diabetes mellitus. 2 plus sugar in urine. Partially controlled. No acetone	5.44	4.37	81
3. S. M.	42	CO poisoning, cleared; reactive depression; mild pneumonitis	4.57	1.89	40
4. M. T.	35	Bromism; essential hypertension; chronic alcoholism	4.16	2.18	55
5. S. H.	6	Little's disease	4.12	1.53	32
6. B.	56	Pneumonia with delirium tremens	3.44	2.10	62
7. W. B.	22	Tuberculous meningitis. T. 102° F.	3.44	2.10	62
8. K. G.	52	Staphylococcus septicemia. T. 102° F.	3.17	2.08	65
9. M. W.	45	Submersion and mild pneumonitis. T. 101° F.	3.07	2.08	67
10. L. S.	52	Diabetic coma. 4 plus sugar and 4 plus acetone in urine...	...	43.5	..

Three patients with diabetes mellitus were studied. Case 2 (N.J.), which was partially controlled, showed an elevation in the spinal fluid only. Case 1 (A.G.) showed a marked elevation in the blood and cerebrospinal fluid and case 10 (L.S.) showed a

marked elevation in the cerebrospinal fluid. Unfortunately, the blood sample in this latter case was lost. Cases 1 and 10 were severe diabetics. Interestingly, pyruvic acid studies done in these three cases on the blood and cerebrospinal fluid yielded normal figures in every instance but one (L.S.). Here, there was an increase in pyruvic acid of one mgm. per cent in the blood which certainly could not account for the marked increase noted in the spinal fluid. Even more interesting is the fact that in this case the cerebrospinal fluid pyruvic acid level was normal. This is additional proof that the B.B.S. figures cannot be used as an index of pyruvic acid levels in the body fluids.

The other patients had normal figures in the blood and cerebrospinal fluid. Four of these patients had temperatures ranging from 101° to 103° Fahrenheit.

As shown by Chart XIII, there was no instance of any elevation of the B.B.S. in the blood or cerebrospinal fluid. The figures in general tended to be somewhat lower than those seen in our adult groups, but they all fell well within the range of normal. In 58 additional cases, the B.B.S. in the blood alone was studied. Here again, the figures were all normal, ranging from 2.42-4.90 mgms. per cent. In five additional cases of conduct disturbance, all associated with mental deficiency, the spinal fluid alone was analyzed for B.B.S. The figures were entirely normal (1.02-1.83 mgms. per cent).

SUMMARY AND CONCLUSIONS.

The levels of bisulfite binding substances (B.B.S.) in the blood and cerebrospinal fluid were studied in 222 patients with neuropsychiatric and medical disorders and the following conclusions reached:

1. The usual range of B.B.S. in the spinal fluid is 1.00-2.25 mgms. per cent, which is usually 35-60 per cent of the amount found in an equivalent blood sample.
2. The B.B.S. may or may not be elevated in cases of clinical vitamin B₁ deficiency (peripheral neuropathy, beri-beri—possibly Korsakoff and Wernicke's syndromes) but this is also true for conditions in which there is no clinical evidence of vitamin B₁ deficiency. Eight cases of peripheral neuropathy in alcoholics were studied. This syndrome in alcoholics is the result of vitamin

CHART XIII.

BEHAVIOR AND CONDUCT DISTURBANCES (TOTAL 93 CASES).

	Name.	Age.	Additional remarks.	Blood B.B.S., mgms. %.	C.S.F. B.B.S., mgms. %.	C.S.F. Blood, %.
1.	F. A.	14	Conduct disturbance	4.88	1.22	25
2.	U. W.	4	Behavior problem; mental deficiency	4.51	1.62	36
3.	M. J.	12	Conduct disturbance; mental deficiency	4.51	1.62	36
4.	B. E.	14	Conduct disturbance	4.39	1.55	35
5.	M. J.	14	Conduct disturbance; underdeveloped; undernourished	4.32	1.17	27
6.	W. H.	7	Mental deficiency; progressive muscular dystrophy	4.29	2.01	47
7.	R. A.	14	Mental deficiency	4.25	1.24	29
8.	A. N.	14	Conduct disturbance; chronic tonsillitis	4.23	1.61	38
9.	H. J.	14	Conduct disturbance	4.16	1.32	32
10.	L. G.	3	Behavior problem	3.86	1.79	46
11.	M. G.	15	Conduct disturbance	3.82	1.27	33
12.	M. A.	14	Conduct disturbance	3.76	1.13	30
13.	H. M.	13	Conduct disturbance	3.52	1.40	40
14.	K. R.	6	Mental deficiency; cretinism...	3.50	1.40	40
15.	W. T.	14	Conduct disturbance	3.50	1.34	38
16.	M. T.	15	Borderline intelligence	3.50	1.34	38
17.	V. D.	12	Conduct disturbance	3.46	1.38	40
18.	D. D.	11	Psychopathic personality	3.38	1.04	31
19.	K. K.	8	Behavior disorder; hyperkinesis; neurotic traits	3.23	1.42	47
20.	S. M.	15	Sex offender; epilepsy; (idopathic?)	3.16	1.03	33
21.	P. H.	16	Conduct disturbance	3.12	1.12	36
22.	S. A.	13	Conduct disturbance; congenital lues	3.08	1.28	47
23.	M. B.	14	Conduct disturbance	2.87	1.05	37
24.	F. T.	15	Conduct disturbance; mental deficiency	2.72	1.03	38
25.	J. B.	10	Conduct disturbance; neurotic traits	2.71	.88	32
26.	B. G.	10	Borderline intelligence	2.65	1.04	39
27.	S. C.	12	Conduct disturbance	2.49	1.25	51
28.	B. C.	15	Conduct disturbance	2.40	.93	39
29.	W. R.	15	Conduct disturbance	2.27	.67	29
30.	W. S.	14	Conduct disturbance	2.00	.42	21

B₁ deficiency.¹⁴ Four cases showed an elevated B.B.S. in the blood or cerebrospinal fluid or both, and the other four had normal figures. These variations obtained in both acute and chronic cases. Hence, the B. B. S. in the blood and cerebrospinal fluid cannot be used as an indication of vitamin B₁ deficiency.

3. A comparatively large group of psychiatric disorders, including alcoholic psychoses, schizophrenia, manic-depressive psychoses, miscellaneous psychoses and neuroses and behavior and conduct disorders in children were studied. No constant deviation from the normal was found. Uncontrolled diabetes with marked acetoneuria shows a marked elevation in B.B.S.

4. Paraldehyde causes an elevation of B.B.S. in the blood for 24 hours. It is suggested that the method employed causes a partial hydrolysis of paraldehyde to acetaldehyde, which latter binds bisulfite and thereby increases the total B.B.S.

5. The B.B.S. is not an accurate indication of the pyruvic acid levels in the blood or cerebrospinal fluid. Mention is made of several cases of peripheral neuropathy in alcoholics, with elevated pyruvic acid levels in the body fluids and a normal total B.B.S. Similarly, mention is made of several cases with marked elevation of B.B.S. in the blood and cerebrospinal fluid and a normal pyruvic acid level.

6. In cases of elevated B.B.S. in the blood or cerebrospinal fluid, the factors which may contribute to that total must be individually analyzed. Pyruvic acid is only one of these factors.

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THE TREATMENT OF THE PARKINSONIAN SYNDROME WITH BULGARIAN BELLADONNA ROOT AND AMPHETAMINE (BENZEDRINE) SULFATE.*

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The alkaloid derivatives of the belladonna group: scopolamine, hyoscine, atropine and stramonium, have been used with varying success in the treatment of the sequelae of encephalitis lethargica (Parkinsonian syndrome). Patients with idiopathic or arteriosclerotic Parkinsonism have been found to respond poorly to these alkaloids. The employment of more than one of these compounds in combination or in series has yielded, at times, better results than any of them alone (synergistic effect). However, the exact proportions of these alkaloids in combination did not receive much attention until the advent of the Bulgarian belladonna root treatment.

Since 1936, amphetamine sulfate has been employed in the treatment of post-encephalitic Parkinsonism. Solomon, Mitchell and Prinzmetal,¹ and others have pointed out that amphetamine sulfate administered alone had less therapeutic value than when employed in conjunction with the drugs of the belladonna group. We² reported that amphetamine sulfate had a beneficial synergistic action with stramonium, scopolamine or atropine in patients with post-encephalitic states, including Parkinsonism when there were minimal organic defects and personality alterations, a situation that obtained particularly in the early cases without psychosis. We administered 10 to 40 mg. of amphetamine sulfate orally in divided doses to 21 cases without psychosis, and of these 14 were

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to some extent improved by the treatment. The beneficial effects were observed particularly in the subjective symptoms, although occasionally tremor, rigidity and excessive salivation were moderately ameliorated. We observed that the initial improvement was prompt, and greater in degree than the response later in the treatment.

We also studied the effect of amphetamine sulfate combined with belladonna alkaloids in 11 patients with psychoses due to chronic encephalitic states. Of these, six improved moderately and exhibited less dullness and confusion. All of the unimproved cases were fairly well advanced. Along with other observers, we noted that latent paranoid states were activated or aggravated by the treatment. We have also employed amphetamine sulfate in combination with two or more of the belladonna alkaloids given simultaneously or in sequence. The results were slightly better than when amphetamine was used with only one of these compounds. In patients with arteriosclerotic or idiopathic Parkinsonism, the combination of amphetamine sulfate with the belladonna alkaloids was of little value.

The belladonna root treatment of the Parkinsonian syndrome was introduced in 1926 by a Bulgarian herbologist, Ivan Raeff of Chipka. Since that time a number of favorable reports have appeared in the European literature. During the past year, Vollmer,³ Fabing⁴ and Gayle,⁵ who were the first to present the results of the use of the Bulgarian treatment in this country, published reviews of the foreign reports. The basic principle of this treatment is the use of the belladonna alkaloids combined in a fixed proportion.

Fabing⁴ treated for six months or more a series of 23 patients exhibiting post-encephalitic Parkinsonism with the white wine extract of Bulgarian belladonna. Nine were markedly improved, 7 moderately improved, 6 slightly improved, 1 unimproved. Maximal treatment with other drugs commonly used for Parkinsonism, such as stramonium and hyoscine, had previously failed to produce such improvement.

Vollmer³ was the first to employ a synthetic combination, "rabellon," which contains the same alkaloid concentration and proportion as was found by analysis in the clinically most effective extracts of Bulgarian belladonna root. This synthetic preparation

was found by Vollmer to be as effective as the natural extract. Twenty-six patients were treated, 16 of whom were diagnosed as post-encephalitic Parkinsonism, and 10 as the arteriosclerotic or degenerative type. Among 16 post-encephalitic cases, 14 showed an objective and subjective improvement, which in some cases was very marked. A number of this group took up their former employment.

Gayle⁵ stated that all of the 30 post-encephalitic cases treated with Bulgarian root (rabellon) showed varying degrees of improvement, both in the subjective and objective spheres. All the cases with psychosis accompanying their Parkinsonism were benefited. Of the arteriosclerotic patients, two of five showed slight improvement. The symptoms in every patient returned after the withdrawal of the Bulgarian treatment. Each of the patients with oculogyric crises was benefited materially. Many of the helpless and completely or partially bed-ridden patients after a short period were able to feed themselves and look after their wants. Neal⁶ reported that in chronic encephalitis better results followed the use of the Bulgarian belladonna treatment than that of hyoscyne, stramonium or amphetamine.

Disertori⁷ was the first to prescribe the Bulgarian root in combination with amphetamine sulfate. In a series of 27 patients, 18 were benefited. He stated that, in suitable cases, after the individual dosage of belladonna had been determined, amphetamine sulfate should be used as a subsidiary drug and might then prove of great value in altering symptoms unchanged or insufficiently influenced by belladonna (particularly muscular asthenia, drowsiness and oculogyric crises).

Forster⁸ treated four cases of Parkinsonian syndrome with amphetamine sulfate orally in addition to Bulgarian belladonna (rabellon) and atropine. He reported that the results were inconclusive. We⁹ have previously briefly mentioned the use of amphetamine sulfate in combination with Bulgarian belladonna.

PRESENT INVESTIGATION.

We are reporting herein the results of treatment in 25 cases of the Parkinsonian syndrome. Fifteen of these were of the post-encephalitic type, and 10 were of the arteriosclerotic or the idio-

pathic type. Seven of the post-encephalitics were psychotic, but only one arteriosclerotic was considered to have a psychosis. Because many of these patients had been subjected to previous studies, they were particularly suited for an investigation of the comparative effect of the Bulgarian belladonna root preparation with and without amphetamine sulfate.

METHOD OF PROCEDURE.

The treatment of these patients can be simplified by dividing it into the following stages: (1) stramonium, scopolamine or atropine alone; (2) stramonium, scopolamine or atropine in combination; (3) stramonium, scopolamine or atropine in sequence or in combination supplemented by amphetamine sulfate; (4) Bulgarian belladonna preparation alone; and (5) Bulgarian belladonna preparation supplemented by amphetamine sulfate. The treatment of the first three stages has been discussed above and in previous communications.

We employed "rabellon," which as previously stated is a combination of the belladonna alkaloids, containing the same concentration and proportion of the various alkaloids as was found by analysis in the clinically most effective extracts of Bulgarian belladonna root. It is available in tablets scored for division into quarters. Each tablet contains hyoscyamine hydrobromide 0.4507 mg., atropine sulfate 0.0372 mg., and scopolamine hydrobromide (hyoscine hydrobromide) 0.0119 mg., in a combined amount equivalent to 0.5 mg. of total alkaloids expressed as hyoscyamine hydrobromide. Each tablet is the approximate equivalent of four drops of a white wine extract of Bulgarian belladonna root.

The procedure for administering "rabellon" depends on establishing the optimum dose for the individual patient. The initial dosage was one-quarter tablet the first day. This was increased to one-quarter tablet twice a day the second day, one-quarter tablet three times a day the third day, one-half tablet three times a day the fourth day, three-quarters tablet, three times a day the fifth day, one tablet three times a day the sixth day, and one and a quarter tablets three times a day the seventh day. The patient was instructed to eliminate all alcohol, coffee and nicotine, and to avoid as far as possible meats, particularly spiced meats. When the

minimum dosage that produced the optimum effect was established, this dosage was maintained thereafter.

In the individuals who appeared to tolerate the drug poorly, the following regime was substituted: one-quarter tablet the first day; one-quarter tablet twice a day the second day; one-quarter tablet two or three times a day on the third, fourth and fifth days; one-half tablet three times a day on the sixth, seventh and eighth days; three-quarters tablet three times a day or one-half tablet four or five times a day for the ninth, tenth and eleventh days; and one tablet three times a day or one-half tablet six times a day for the twelfth, thirteenth and fourteenth days. In principle, the number of tablets desired on a single day is divided into a sufficient number of doses that there is no reaction after a single administration. The appearance of mild toxic manifestations may be of value in establishing when the optimum dosage has been exceeded. The higher the dosage, the more cautiously the drug must be given. Once the most suitable dose has been determined, this dosage is continued thereafter. Omission of the drug for but a few days necessitates a sharp reduction in the dosage in resuming treatment. The optimum dosage was 3 to 5 tablets daily in most cases.

After the patients had been maintained on a stable program of "rabellon" medication for several weeks, the administration of amphetamine sulfate was begun. The initial dose was 5 mg. in the morning and at noon. The dosage was increased at weekly intervals by increments of 5 mg. until the maximum of 30 to 40 mg. was reached. The optimum dosage was 15 to 20 mg. daily in most cases. It was usually necessary to decrease the dose of "rabellon" as the dose of amphetamine was increased.

Improvement in all patients was judged by both the subjective and the objective responses.

CASE REPORTS.

The following are illustrative cases:

GROUP I. POST-ENCEPHALITIC PARKINSONISM.

A. WITH PSYCHOSIS.

CASE I.—A. F., female 14 years of age; diagnosis—psychosis with epidemic encephalitis; narcolepsy; duration—two years. The patient was admitted to the hospital in October 1939. Two years prior, she developed

encephalitis, and following this illness became very drowsy, fell asleep frequently during the daytime, and was awakened with difficulty. Her family reported that she gained considerable weight, was unsteady in her gait and tremulous. She complained of headaches and uncontrollable weakness. Prior to hospitalization she received ephedrine without benefit. Examination revealed diplopia, oculogyric crises, difficulty in coordination of motor activity, ataxia and pathologic somnolence (narcolepsy). The Romberg was positive. The patient fell asleep while talking to the examiner, appeared dull and listless, and had difficulty in gathering her thoughts because of her confusion. She thought people were against her and was irritable. Defects were present in her recent and remote memory.

The patient was given 30 to 60 mg. of amphetamine (benzedrine) sulfate by mouth daily, and while receiving this medication was not as somnolent as previously, but showed very little general improvement and an accentuation of her paranoid reaction. After the amphetamine was discontinued, stramonium, min. 30 three times daily by mouth, was administered with very little effect. She was then given a combination of amphetamine mg. 30 and stramonium min. 120 daily in divided doses with improvement in the somnolence. When given "rabellon" alone, however, she was more somnolent, irritable and confused, but less ataxic and tremulous. She complained of seeing double, but the oculogyric crises were diminished in frequency. The following week she was placed on the combination of amphetamine sulfate and "rabellon" in gradually increasing doses. Within a week she showed marked improvement, and soon after was discharged. This regime was continued at home under supervision. She attended the clinic twice weekly. The patient was completely relieved of the somnolence, confusion and irritability and she no longer exhibited tremor, ataxia and oculogyric crises.

However, the patient developed two toxic reactions during the latter part of the treatment. The first occurred while she was receiving "rabellon" alone. This consisted of sub-normal temperature followed by hyperpyrexia (rectal temperature 102 degrees F.), marked dryness of the mouth, nausea, headache, increase in unsteadiness and excitement. The reaction appeared to be due in part to overdosage, while we were determining the optimum dose. When the dosage was decreased to $\frac{1}{4}$ tablet four times daily, these symptoms disappeared. The second toxic reaction became evident while the patient receiving both amphetamine and "rabellon." This manifested itself in an almost complete mydriasis and paralysis of accommodation, which necessitated temporary discontinuance of all medication. After withdrawing the medication for a few days, it was resumed without incident, and is now being employed intermittently. At the present time the patient is attending school daily, and is making a very good adjustment. She has entirely recovered from her psychosis.

CASE II.—M. S., female, 14 years of age; diagnosis—psychosis with epidemic encephalitis; duration—three years. The patient was silly, confused, hyperactive, restless, overtalkative and mischievous. Tremor of the hands, diplopia and excessive salivation and perspiration were present. She became

worse when amphetamine sulfate alone was administered. Hyoscine alone and stramonium and amphetamine in combination evoked very little response. She improved only slightly with "rabellon" alone, and continued to be silly and annoying. When amphetamine and "rabellon" were given in combination, the tremor was improved moderately and less destructive tendencies were present, although her restless behavior continued. After over two months of treatment she was classified as unimproved.

B. WITHOUT PSYCHOSIS.

CASE III.—P. T., male, 8 years of age; diagnosis—without psychosis: post-encephalitic state; duration—2½ years. In 1937, at the age of six, the patient was admitted to a general hospital with encephalitis. At that time he exhibited athetoid movements, a convergence defect, cog-wheel rigidity, poor coordination and diminished reflexes. Following this illness, the boy was hyperactive and restless, and continued to manifest tremors of the upper extremities. Because of his destructive activities, in November 1939, he was referred to the psychopathic hospital clinic. He was treated first with amphetamine sulfate alone; this produced very little improvement. Stramonium alone was then employed. Although he had responded favorably to this medication previously, he did not appear to benefit from it at this time. He was then placed on a combination of amphetamine and stramonium and exhibited slight improvement. When "rabellon" alone, one-half tablet three times a day, was administered, there was also some improvement. However, when the combination of amphetamine and "rabellon" was employed, the patient displayed marked improvement in four days, and became very tractable. The tremor and restlessness disappeared. As soon as the patient became more cooperative, psychotherapy and play techniques were utilized. This case was complicated by many psychogenic factors, particularly in the home situation.

CASE IV.—A. S., female, 33 years of age; diagnosis—without psychosis: post-encephalitic Parkinsonism; duration—10 years. The patient exhibited oculogyric crises, impaired speech, pill-rolling tremor of the hands, rigidity, weakness, ataxia and festinating gait. For seven years she received stramonium and hyoscine in sequence or in combination with but little benefit. For the past year, she was given amphetamine and stramonium in combination intermittently and exhibited temporary amelioration for a few weeks each time the combination was administered. On "rabellon" alone she showed moderate improvement. When the combination of "rabellon" and amphetamine sulfate was employed, the coarse tremor of the right arm diminished, the rigidity was decreased, and the oculogyric crises were very much diminished in frequency, although not abolished. Her alertness and her speech activity improved remarkably. Before the combination of "rabellon" and amphetamine sulfate was administered, the patient was not able to attend the clinic weekly because of her difficulty in locomotion; since this therapy was instituted, she has visited the clinic weekly for two months.

CASE V.—G. G., male, 40 years of age; diagnosis—without psychosis: post-encephalitic Parkinsonism; duration—6 years. Since 1933, following an attack of acute encephalitis, the patient exhibited tremor, which began in the left arm, and later involved the right arm and the face. There was excessive salivation, rigidity, oculogyric crises, monotonous voice, excessive perspiration and pathologic somnolence (narcolepsy). He had received hyoscine, atropine and stramonium with only slight improvement. When examined in the clinic in December 1939, he was found to have pill-rolling type of tremor of the hands, tremor of the lips and tongue, mask-like facies, cog-wheel rigidity of the left upper extremity, moist skin, flushed face, ataxia and festinating gait. He was given the combination of stramonium and amphetamine, with decrease in the frequency of the oculogyric crises, but without change in the somnolence and the difficulty in locomotion. Subjectively he was improved. When given "rabellon" alone, the patient was less drowsy; and felt better; excessive salivation and perspiration disappeared. There was much less tremor, and greater ease in locomotion. However, he complained of blurring of vision.

The patient was then placed on the combination of amphetamine sulfate and "rabellon," and within two weeks his tremor and rigidity were greatly diminished, although he still had minor difficulty with his vision. The drowsiness was eliminated. One week later he became restless, felt nauseated and vomited. These manifestations were interpreted as a toxic reaction from overdosage. On a reduced amount of "rabellon," these symptoms subsided. The gait continued ataxic and the oculogyric crises still occurred at times, but subjectively there was marked improvement. He was maintained on $\frac{1}{2}$ tablet of "rabellon" four times a day, and 20 mg. of amphetamine sulfate two times a day.

GROUP II. ARTERIOSCLEROTIC AND IDIOPATHIC PARKINSONISM.

A. WITH PSYCHOSIS.

CASE VI.—G. F., female, 55 years of age; diagnosis—psychosis with idiopathic Parkinsonism; duration—two years. The patient had gradually developed a picture of paralysis agitans. For several weeks prior to admission to the psychopathic hospital in December 1939, she had refused to eat, to talk or to care for herself, and became markedly depressed and self-absorbed. She had received previously stramonium and hyoscine without benefit, but had moderate improvement when the combination of stramonium and amphetamine sulfate was administered. On admission, the patient exhibited a well advanced syndrome of paralysis agitans with mask-like facies, dysphagia and sialorrhea. She sat constantly in a crouched position.

The patient was treated first with "rabellon" in gradually increasing doses. On this regime she manifested marked improvement mentally and physically and began to talk. As the dosage of "rabellon" was increased, the patient developed a toxic reaction consisting of hyperpyrexia, emesis, extreme rest-

lessness and erythematous rash. The manifestations disappeared with reduction of the dose. Within a week there was some decrease in the amelioration of the symptoms, particularly in the speech activity. However, she was sufficiently improved to be discharged after three weeks of hospitalization. She continued to attend the clinic and to take "rabellon" alone. In January 1940, she was found to have regressed considerably, so amphetamine sulfate was administered in addition. On the combined medication, she again showed considerable improvement, appeared much more alert and exhibited markedly diminished tremor and no salivation. A few weeks later, however, the improvement disappeared and the patient became unresponsive, could not feed herself, and refused to leave her bed. The sialorrhea and tremor returned. The amphetamine was discontinued without improvement and the dosage of "rabellon" was increased without influencing the state of the patient, so this medication was stopped. She responded temporarily to elixir of iron, quinine and strychnine, but soon relapsed into her previous state. Rehospitalization was indicated but refused by the family, who were uncooperative, quarrelled among themselves and neglected the patient.

B. WITHOUT PSYCHOSIS.

CASE VII.—F. Mc., male, 53 years of age; diagnosis—without psychosis; idiopathic Parkinsonism; duration—10 years. This patient exhibited tremor, rigidity and mask-like facies. For eight years he had received stramonium and hyoscine in sequence and in combination with little benefit. In January 1940 he was given the combination of stramonium, hyoscine and amphetamine sulfate with practically no change in his condition. A month later he received "rabellon" alone, and seemed to be somewhat better. Shortly after, the combination of "rabellon" and amphetamine sulfate was administered, and on this regime there was still greater improvement, so that the patient felt stronger, and could climb up and down the stairs. There was a marked decrease in the tremor. The improvement has continued to the present.

CASE VIII.—A. F., male, 61 years of age; diagnosis—without psychosis: arteriosclerotic Parkinsonism; duration—three years. This patient exhibited mask-like facies, unequal pupils, rigidity of all extremities, intention tremor, slowness of speech, occasional blurring of vision, typical Parkinsonian gait and peripheral and retinal arteriosclerosis. When hyoscine was administered, a severe rash appeared, and the drug had to be discontinued. He was treated with the combination of stramonium and atropine for two years with very little success. In January 1939 he was given the combination of stramonium and amphetamine sulfate. After a short period of improvement, he became worse, and was forgetful, silly and confused. The aggravation of symptoms disappeared when the amphetamine was discontinued. Four months later, however, he again received the combination of stramonium and amphetamine with moderate benefit. After a few weeks, he was given amphetamine sulfate alone. This produced subjective improvement, but no objective alterations. In December 1939, "rabellon" alone was administered. On this drug

the patient seemed much better, was less tremulous and restless, but complained of weakness and dizziness. When amphetamine sulfate in combination with "rabellon" was employed, the patient showed considerable improvement, and stated that he felt better than any time during his illness. Tremor and rigidity were moderately diminished.

RESULTS.

On the combination of "rabellon" and amphetamine sulfate the following results were obtained. Of the 15 cases of post-encephalitic Parkinsonism, eight exhibited marked improvement, three moderate improvement, and four no benefit. Seven of the eight cases without psychosis and four of the seven cases with psychosis were favorably influenced by the therapy. Of the ten cases of idiopathic and arteriosclerotic Parkinsonism, five revealed considerable improvement and five were unimproved. The idiopathic case with psychotic manifestations, showed temporary amelioration but relapsed and was classified as unimproved.

DISCUSSION.

In as much as our experience has been limited to a relatively small number of cases (25) which have been treated for a short time (6 to 7 months), we cannot formulate final conclusions. However, in this series of patients, the combination of "rabellon" and amphetamine sulfate has produced the most satisfactory response of the therapies we have employed. This was true in both the degree and in the rapidity of improvement. "Rabellon" alone appeared to be more effective therapeutically than amphetamine sulfate alone, or the other belladonna alkaloids alone. In some post-encephalitic cases, however, the combination of amphetamine sulfate and other derivatives of the belladonna group appeared to be as effective as "rabellon" alone. In the arteriosclerotic and idiopathic Parkinson states, "rabellon" with or without amphetamine produced the most favorable effect, although the results are not as gratifying as in the post-encephalitic group.

The cases of shortest duration seemed to respond best, although some of the protracted cases were surprisingly improved. Some patients reacted favorably when the therapy was first instituted, but sooner or later became refractory to the medication. This may be a manifestation of tolerance, because increasing doses are often

required on a continuous regime. As the dosage is increased, however, toxic reactions are more prone to occur. Intermittent therapy is desirable in these cases. It is recognized that this treatment is symptomatic, and does not, as a rule, alter the inherent pathologic process. The role of psychogenic factors and psychotherapeutic procedures in influencing the results have to be considered. The unreliability of patients with Parkinson's syndrome in regard to their subjective analysis of the response and their ability to adhere to the regime is a prominent source of error in judging results and toxic reactions. The post-encephalitic cases with narcolepsy have responded better to the combination of any member of the belladonna group with amphetamine sulfate, than to any of these medications alone. We ¹¹ have called attention to this previously. The use of "rabellon" and stramonium in combination with amphetamine in selected cases should be investigated.

TOXIC REACTIONS.

The administration of "rabellon" alone has produced the following reactions: sub-normal temperature or hyperpyrexia, dryness of the mouth, nausea, vomiting, constipation, dysuria, headache, increase in unsteadiness, restlessness, excitement, auditory and visual hallucinations, mydriasis, difficulty in accommodation, blurring of vision and erythematous rash. The toxic reactions caused by amphetamine alone have been described previously.² The combination of "rabellon" and amphetamine sulfate has produced the following toxic manifestations: restlessness, irritability, almost complete mydriasis with paralysis of accommodation, feeling of faintness and headache. In clinic practice, great caution must be exercised in administering these drugs, particularly in the idiopathic and arteriosclerotic types. The physical status must be checked constantly. Because of certain synergistic and coalitive actions, less "rabellon" is necessary when amphetamine sulfate is administered, so that the toxic effects are minimized by employing the latter drug.

SUMMARY.

1. A series of 25 patients with Parkinsonian syndrome, including 15 of the post-encephalitic type, and 10 of the arteriosclerotic or

idiopathic type have been treated with the combination of Bulgarian belladonna root (rabellon) and amphetamine (benzedrine) sulfate. Of the post-encephalitic cases, 11 showed some improvement. Of the other types, five were beneficially influenced.

2. Our experience indicated that this therapy is superior to other forms of treatment.

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HISTAMINE IN THE TREATMENT OF PSYCHOSIS

A PSYCHIATRIC AND OBJECTIVE PSYCHOLOGICAL STUDY.*

By R. W. ROBB, M. D., B. KOVITZ, M. D., AND D. RAPAPORT, PH. D.

I. PSYCHIATRIC LITERATURE AND PHYSIOLOGY.

Literature on the pharmacotherapy of psychoses has included few clinical reports on histamine. Gildea, *et al.*,¹ in 1935 gave histamine to three catatonics to investigate the correlation between increased cerebral circulation and the effects of sodium amytal, and saw no remission in symptoms. In 1938, Marshall and Tarwater,² on the assumption that psychoses are allergic responses and hence capable of non-specific desensitization, gave small graded doses to a heterogeneous collection of 35 psychotics and described it as a "new ambulatory treatment," henceforth permitting the general practitioner to treat the ambulant psychotic simply with an ampule and a syringe.³ Hill,⁴ in 1938, reported good results, especially in chronic cases, from a combined treatment with relatively small doses of histamine and insulin, ascribing the effects to an increase in capillary permeability to the "substance necessary for the functional activity of the brain cells."

The prime actions of histamine⁵ appear to be (1) stimulation of glandular secretion, especially gastric, (2) stimulation of smooth muscle, especially uterine and bronchial, (3) dilatation and increased permeability of capillaries, with secondary fall in blood pressure, slowing of circulation and hemoconcentration. The relation of histamine to the phenomena of anaphylactic shock is well known. Gibbs, Gibbs and Lennox⁶ noted an increase in cerebral blood flow following intravenous injection of histamine, independent of the changes in systemic blood pressure. A cardiac factor in histamine shock is stressed by Klisiecki and Holobut.⁷

What considerations have suggested the applicability of histamine to mental disease? Alteration in capillary permeability, alter-

*The histamine phosphate employed in this experiment was furnished through the courtesy of George A. Breon Company, Kansas City, Missouri.

ation in cerebral blood flow, secondary effects of a vascular shock on cerebral function, and its further psychobiologic action as a non-specific "shock to the bodily economy," in the phrase of D'Elseau and Solomon.⁸

In the present experiment, a course of histamine phosphate was given to 12 psychotics with the intention (1) to treat psychoses by means of a vascular (histamine) shock and to note its physiological conditions, (2) to measure the clinical reaction by psychiatric interview and parallel observation, (3) to check clinical impressions by the independent application of a more objective and quantitative psychological method, based on earlier investigations.⁹

Injection of the drug in a 1:1000 solution was made into the deltoid muscle, beginning with doses of .01 mg. to exclude dangerous sensitivity, and continued on alternate days with increments of 0.1 to 0.2 mg. until the 1.0 mg. level was reached. This was twice repeated, and the quantity raised thereafter 1.0 mg. per dose to a maximum of 7.0 mg.

Characteristic symptoms appeared within 1 or 2 minutes of injection: flushing, especially of the face, with subjective reactions of warmth, throbbing fullness in the head and palpitation. As the dosage passed 2 or 3 mg., general discomfort with mild prostration increased, headache and palpitation were severe, often with a transitory sense of dyspnea and oppression in neck or chest, and certain cases showed pilomotor stimulation (goose-flesh), itching and a dry cough. Conjunctivæ were injected, eyes watery, the skin first blotchily and then diffusely red and hot. Symptoms gradually abated in 30 to 60 minutes.

Reactions to the treatment varied from fear and annoyance to indifference. One patient enjoyed the physical sensations, which recalled his feelings during masturbation. Despite the discomfort, fear decreased with familiarity.

Typical circulatory changes were an almost immediate drop in systolic and diastolic pressure of 10 to 45 mm. mercury with a simultaneous increase in pulse rate of 30 to 60 beats per minute. Individual variation in sensitivity was marked. Even with systolic pressures of 60 to 90 and tachycardias of 120 to 160, physical prostration was never too alarming. Circulatory changes did not correlate evenly with histamine dosage, and one had the impres-

sion that a certain tolerance was developed. Good physical health was maintained; 7 of the 12 patients gained in weight and 2 lost.

II. PSYCHIATRIC AND PSYCHOLOGICAL PROCEDURE.

The psychiatric aim of the experiment was to establish whether or not histamine or histamine shock could influence the psychosis. For this purpose careful psychiatric interviews were conducted to note and compare the habits, accessibility, blocking, mobility, delusions, etc., of the patients before and after the treatment.

The psychological aim of the experiment was to establish the psychological change elicited by the drug. For this purpose, the Rorschach test was administered to the patients before and after the course of treatment.⁹ The patients were, furthermore, asked to recall the story quoted below,¹⁰ on each of the subsequent twenty-four days. It was expected that the changes the story would undergo in the course of repetition would be characteristic of the patients.

The patients were 12 in number (7 male and 5 female) consisting of ten schizophrenia, catatonics and two borderline cases (female) of psychoneurosis and manic-depressive psychosis, depressed type. All except two catatonics had previously received metrazol treatment without improvement. The two borderline cases had not received metrazol.

General psychiatric changes. As seen in review, the treatment effected no spectacular change on the group as a whole. However, the most rigid catatonics displayed more emotion and curiosity as the physical reactions grew more intense, and certainly appeared more free, responsive and accessible at the conclusion of the procedure, although their gross behavior was little altered. Those, however, who were nearer the simple type or were less openly catatonic, and the two depressive cases, were left essentially unchanged. The simple cases mentioned above showed certain paranoid mechanisms.

General psychological changes as shown in the Rorschach test. The following statistics will concern the catatonic group, for it was noted in the metrazol-prognosis studies already mentioned⁹ that catatonics have a specific reaction to metrazol and amytal. The Rorschach test in schizophrenia was described by M. R.

Ovsiankina¹¹ and several others;¹² this paper will therefore take for granted its established norms.

Table I shows that the manner of approach of these patients changed in the same direction as that of patients who had received metrazol. The change here is, however, not so significant as with metrazol. This change should correspond with a slightly better, more realistic thinking of these patients as a group.

Table II shows an increased movement and color score after treatment.

TABLE I.
MANNER OF APPROACH AVERAGES.

	Whole answer %	Detail %	Small detail %
Before histamine treatment.....	44.1	49.4	6.5
After histamine treatment.....	35.3	58.1	6.6
Before metrazol treatment (9).....	41.0	45.0	14.0
After metrazol treatment (9).....	25.0	58.0	17.0
H. R. Ovsiankina normal subjects.....	24.0	62.0	14.0

TABLE II.
MOVEMENT AND COLOR SCORE AVERAGES.

	FC.	CF.	C.	Color sum.	Movement.
Pre-histamine	0.3	0.7	0.3	1.3	1
Post-histamine	0.6	0.5	0.7	1.85	1.4
Pre-metrazol	0.38	1.31	1.0	3.0	0.7
Post-metrazol	0.66	1.33	1.3	3.61	1.05

Comparison again shows an identical direction of change following metrazol and histamine. We suggest drawing no quantitative conclusions from the comparison, as these averages are both obtained from comparatively small groups. Such an increase in movement and color scores is generally interpreted as indicating a more free and responsive affectivity and psychomotility, as well as decreased blocking.

Table III shows a decrease in anatomical answers, indicating a decrease in blocking. The changes are here, too, in the same direction as those following metrazol. All the changes indicated in the three tables are favorable for the group as a whole but are rather slight. *Their significance is emphasized by the fact that at least*

seven of the ten patients show individually the same direction of change as does the average described above. All the changes following histamine are in the same direction as those shown by catatonics after treatment with metrazol, although less significant.

Psychological changes and the repetition of the story.—The story quoted¹⁰ was presented visually and acoustically at the same time at the beginning of the treatment, and daily recalls were recorded. It is beyond the scope of this paper to discuss the implications of this material. One fact, however, deserves mention here. Most of the catatonics changed the story¹³ basically. Those who did not were the same group characterized earlier as approaching the simple type and less openly catatonic. These patients, reproducing the story accurately, changed least during the treatment. We are far from drawing any conclusions from this coincidence, although

TABLE III.

ANATOMICAL AVERAGES.

	Anatomical percentage.
Pre-histamine	15.5
Post-histamine	9.5
Pre-metrazol	15.0
Post-metrazol	12.2

it is well known that older, inveterate schizophrenics have a more closed and uncommunicative system, not revealing the original roots and dynamisms of the ailment. It would be no surprise to find in the field of memory a difference between those chronic cases in which the emotional complexes do not enter the field of memory, and younger cases in which the emotional revolution of the psychosis is active in distorting memories. We emphasize without drawing any conclusions that this coincidence opens a field of memory investigation which might have bearing on the prognosis, perhaps even diagnosis of psychoses.

III. DESCRIPTIONS OF THE PATIENTS AND THEIR CHANGES.

CATATONICS.

1. E. B. A rangy fellow of 27, suspicious and ever shrewd, devoid of ambition, works in the hospital, reads frequently, usually takes his rest beneath his bed, reveals peculiar ideas of hypochondria and inferiority; has no

experience with women; submitted to treatment with a certain curiosity, and with decrease in suspiciousness divulged his maturatory preoccupations following treatment.

Rorschach shows no change in colors, but one more movement answer and slightly higher animal percentage, indicating somewhat greater stability.

2. F. A. 26, a slovenly, ineffective youth who makes the beds and stands about with averted look, revolving his same problems day after day, responds to difficult questions with blushes and inappropriate grins, appears perpetually worried, muddled and incompetent; is little improved after treatment.

Rorschach shows slight increase of color score, no change in movement score; however, a decrease in blocking (anatomical answers) and stronger expression of anxieties.

3. C. G. 28, standing bull-like and silent, with bowed head and clenched fists, readily confessing in boyish voice his hopeless loss of strength and will through masturbation, and looking as if ready to disintegrate; enjoyed the physical sensations of the treatment, became slightly more free and responsive, and smiled a little, joked, showed more tendency to activity and increased integration.

Rorschach: The most important change is that of colors toward more adaptive color answers and the disappearance of 4 answers with sexual content. Control was distinctly increased, corresponding with improved clinical integration.

4. V. N. 34, with the blank and apathetic stare of a sculptured idol concealing the meager expression of a few vague, silly delusions; during treatment became more responsive, spontaneous and accessible, rather skeptical of his previous delusions, though still peculiar, and now works regularly.

Rorschach: In a desolately coarctated picture, the appearance of the first pure color answer, with a rather significant decrease of blocking (anatomy), is a significant improvement. Answer number increased from 6 to 14. The number of cards failed decreased from 4 to 1.

5. H. G. 22, slim, silent, girlish-faced, inactive, answering little but yes and no, with a frequent silly, sly and irrelevant grin; during treatment became more responsive, more physically active, and began to read a book.

Rorschach: Instead of one impulsive color answer he now has one impulsive, one uncontrolled and one adaptive color answer; the decrease of previously excessive control is marked.

6. L. D. 37, striding manneristically to and fro with half-buttoned trousers, clucking to himself, semi-coherent and hypochondriacal, armored with an impregnable superficiality and dexterous at evading any decisive answer or commitment; after treatment showed a decrease in physical complaints and in his meaningless hypermotility.

Rorschach: The appearance of one movement answer, showing increased psychomotility and bodily stability, is accompanied by disappearance of color answers. Slight increase of animal percentage indicates somewhat greater stability.

7. F. B. 26, boyish, sitting with bowed head, arises at any approach with a dazed expression, and with a vaguely baffled air, tries repeatedly, but without success, to begin an answer to the most simple questions; showed more freedom, but little other gross change at close of treatment.

Rorschach shows one more color answer indicating increased emotional response; slight sign of appearing insight; previously prevailing depressive features (excessive control, popular responses and whole answer percentage) diminished; number of answers increased by 50 per cent. One failure disappeared.

8. M. B. 28, baby-faced, boyish figure, negligently dressed, depressed, natural in manner but reticent, afraid of the world; disliked the treatment and openly expressed a dread of being sent home together with paranoidal fears and a slump in behavior.

Rorschach shows slightly decreased emotional responsiveness, slight increase in depressive features, no gross change.

9. A. S. 24, short, plump, pleasant in speech, somewhat depressed; at conclusion of treatment appeared smiling, busy and active, fairly neat in dress, but retaining a slight idea of reference. Parole is considered.

Rorschach shows a very significant increase in emotional responsiveness, decrease in former depressive features, increase in number of answers, increase in number of human responses, and significant decrease in anatomical answers, giving the greatest change noted in this group.

10. M. B. 25, cold, quiet, stiff, brief and mannered in speech, efficient worker, almost inaccessible except for the admission of some feelings of inferiority; during treatment began to appear more free, smiling and accessible.

Rorschach shows a decreased blocking (decrease in anatomical and whole answer percentages) an increased psychomotility (increase in movement answers) with an increase in answers, in human answers, and in animal percentage, showing a certain change of the picture toward the normal.

MIXED.

11. G. T. 45, runs about, labile in mood, weeping frequently, maternally sympathetic with other patients, full of voluble and incoherent references to the conviction that her health was ruined by a phantasied sexual indiscretion, and all that befalls her was foretold; during treatment became perhaps a trifle more stable in mood, without change in mental content.

Rorschach shows slightly less depression, but the picture is grossly unchanged.

12. L. J. 41, skinny, snivelling, shrinking, beseeching, infantile, weeping over trifles and upset over the least change in her routine; showed no improvement during treatment.

Rorschach shows slightly increased depression, without gross change.

IV. DISCUSSION AND CONCLUSIONS.

A. The administration of histamine was followed by slight improvement both in the clinical picture and Rorschach test for the group, particularly in the characteristic catatonics. From the absence of striking change, one might reflect that while histamine may be able to influence the psychosis in certain cases, cases of long duration and resistant to metrazol were refractory material for eliciting improvement, and cautious administration precluded the effects of a truly profound vascular shock. For future trials, a sharper increase in dosage and even cautious intravenous administration should be considered. Comparison of post-histamine tests with metrazol prognosis studies⁹ suggests that these patients are somewhat more likely candidates for metrazol improvement than they were before histamine.

B. Following histamine, the catatonics showed psychological test changes identical in direction with the changes observed after metrazol. In the depressive cases, the changes differed from those of the catatonics as was also the case with metrazol. Although control series with water injections and without injection were not carried out, the essentially uniform test changes serve to validate the findings. Similarity in psychological response to widely different pharmacodynamic agents without discernible physiological similarity, seems to permit formulation of a therapeutic moment in terms of "nonspecificity." The psychological effects of histamine as of metrazol appear to depend on the personality and illness structure of the patient. The fact that psychological changes following histamine, as shown in the Rorschach test, are in the same direction as those elicited by metrazol and sodium amytal,¹⁴ suggests a non-specific action of the drugs on psychoses. This non-specific action might perhaps be explained by the hypothesis that these drugs interfere with the homeostatic equilibrium, which was shown to be rigid in schizophrenia.¹⁵ There is no clear reason as yet to consider even the profound disturbances of cerebral oxidation by metrazol or insulin as other than more potent exemplars of this principle.

C. The method applied in this experiment is suggested as a means of investigating the psychological effects of drugs capable,

on proper application, of a degree of objectivity and quantitative measurement which seems to the authors otherwise unattainable at the present time.

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 A hunter entered carrying on his back a deer he had killed, threw the animal to the floor, shoved it into a corner with his foot, and sat down to drink with some friends.
 While the hunter was enjoying himself, Confucius arose from his seat, stood in front of the dead deer, and pondered deeply.
 For a long time Confucius stood before the dead deer and pondered deeply.
11. H. R. Ovsiankina: The Rorschach test as applied to normal and schizophrenic subjects. *Brit. J. Med. Psychol.*, XVII: 227-257, 1938.
12. Oberholzer, E.: Zur Differentialdiagnose psychischer Folgezustände nach Schädeltraumen mittels des Rorschachschen Formdeutversuchs. *Z. ges. Neurol. Psychiat.*, 136: 596 (1931).

13. One version of the story after twenty-four repetitions is as follows:
"Once upon a time there was a man, his name was Confusia and he had a deer and he was out in the country and it seems to me that there was more men with him helping him look for his deer and when he found his deer, the deer was dead and he was quite disappointed and that was the story."
14. Orbison, W. D., Eisner, E., Rapaport, D.: Psychiatric implications of Rorschach studies with metrazol and sodium amytal. Submitted to The American Psychiatric Association for presentation at the 1940 meeting.
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PSYCHOBIOLOGICAL THERAPY.*

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The basis of psychobiological therapy lies in the use of critical common sense, when by common sense we mean the capacity to make the best use of sharable data and facts. Trained and critical constructive common sense means simply the best utilization of the inherent and human capacity to make sense out of human situations as they exist rather than resorting to hypotheses about life.

In addition to common sense, however, we must have a workable philosophy or concept of what constitutes man in general, or man as a specific human being, the patient we propose to help. The psychobiological concept insists that we deal with patients as live biological organisms, functioning in a specific mode of *action*. Thus action, rather than mere sensorial representation, or an exclusive utilization of symbolization or verbalization, becomes the central feature of treatment. Psychobiological therapy is activity therapy where activity is understood as the total performance of a natural biological creature.

The concept demands that we view personality function as part of the field of biology in its strictest sense. We cannot accept psychobiology as a study dealing with a special detachable sphere—that of mind—nor disregard the fact that the human personality is a product of integration, each level of integration including the substance and nature and function of the next lower physical-structural components. This is what modern critical common sense observes, formulates and works with in practical life; events and performances of specific persons or live organisms obligatorily considered as mentally integrated functions. It asserts that when we deal with the facts about man and living beings, we cannot ignore the personality functions, but also that we cannot ignore

* Read at the annual meeting of the American Psychopathological Association, Cincinnati, Ohio, May 19, 1940. From The Henry Phipps Psychiatric Clinic, The Johns Hopkins Hospital, Baltimore, Md.

the inclusion of all non-mentally integrated components without which there would be no human beings and no human functions. Psychobiology, or ergasiology, refuses to accept a psychopathology which is not out and out biological, that is, structure-bound as well as meaning-bound, working always in a setting or system of meanings.

This concept demands the recognition of man as an indivisible biological unit, performing under the guidance of symbolization. This is necessary for the fullest understanding of what constitutes the part functions and how they work in the integrated unit which we call the personality in action. We use no parallelistic division into somatic functions or mental functions, preferring to view personality as an integration of all functions, of which mind is only one kind of functioning characterized by symbolization.

Man as the object of natural science is to be studied in his total performance, the overt as well as the implicit, for what he does, as well as for what he thinks or remembers, utilizing the data of observation and of scientific test as well as the material of introspection. The study for understanding and for therapy stands under the same principle as all science. Presented with a case, we are obligated to define the problem we are confronted with and are specifying—the definition of the concrete conditions in which the fact occurs and can be reproduced, the total range of all the facts and factors that enter into the experiment and working, the mode and degree of operation, the range of results and specific samples or trials, and the potentialities of their modifiability. Since in our unitary concept we recognize the inseparability of structure and function, of physical and mental, we must be prepared to inspect all that is going on within the individual at any given moment, using physics, chemistry and biology to explain or modify that which it best explains, but preferring always to see the human subject as a balanced system, a ceaseless state of flux between that which is implicit and overt, conscious and “subconscious,” mental and physical.

Throughout all of nature, organisms exist and function as units. This is the law of individuation. The human person is not merely a summation of component parts but is *integrated* in a particular and highly individual fashion, permitting new functions and cre-

ative possibilities, the qualities of which are never entirely to be predicted by analysis of the component parts alone.

Our domain of pathology cannot stand on mentation alone. It inevitably rests on physics and chemistry and physiology and is derived from an integrated entity, the patient—an entity with a life record or biography in the making, a history beginning with the complaint and its story and precursors and grounded on a type of constitution, partly inherited and partly built up by experience and life exposure. To this the physician adds the direct examination, somatic, neurological, personal and social. These facts are then formulated in their own terms and the physician must be clear on the participation of psychogenic, neurogenic, organogenic, exogenic or constitutional factors, the course and development of the disorder, and the factors of potential modifiability. The overt behavior as well as the implicit functions are open to direct, objectively observable methods of study and analysis of concrete performance.

The subject or personality is organized not only in the present and the past but in his attitude to the future. He differs from moment to moment. The highly organized nature of his integration permits the data of the sense-organs to be brought into perceptive and presentative function. Sensation, memories and anticipations are welded together through constructive imagination and held in interrelation through the associative assets which are focused as attention. Emotions and effects act as diffusely regulative tendencies. On the interrelation of all these special functions depend the qualities of inference and reasoning, planning and choice, action and decision. The result is seen in more or less effective overt performance.

Pathology consists in the disharmony that exists within these component elements that constitute the integrated individual. Treatment of the pathology demands an understanding of the dynamics of the person and of his working, to be pursued as analysis of the complex individual factors with final resynthesis into a more harmonious whole as the balance which constitutes well-being. Psychobiological therapy is objective in that it seeks to view all the facts in their natural setting. The data of introspection or recall are only one aspect of the totality. Thus psycho-

biological therapy is neither merely symptomatic treatment nor limited to psychotherapy. It aims to utilize the resources of the person to bring about melioristic processes, either in the structure or the organ or the person, by control of attitude, reactions and actions, the utilization of orientation in understanding and insight and planning, the adjustment of affective and intellectual imbalances, and the correction of the consequences of preoccupations, dissociations and suggestions.

Understanding must precede treatment. The dynamics of human behavior are best understood in terms of a life biography obtained from all possible sources, from the events of which the dynamics are elicited. The dynamics lie in life, may enter at any phase of development, and may be modified by constitutional, structural or more personal developments. We recognize the importance of the early life period in the formation of habits, attitudes and reactions entering into the subsequent personality growth, but we do not make of childhood the exclusive dynamics of a lifetime where each phase from childhood, adolescence, maturity and senescence may contribute its own factors specific to that period. The facts to be dealt with may be sought at any level of integration. Where there are ways of effecting modification from the organismal angle (drugs and regulation of function), the resources are used, but there is also need of the interfunctional personality adjustment and personality functioning in the shaping of attitudes toward past and future, reality and fancy, and the balancing of interests and tendencies in various tasks. The choice of method must be determined by the individual case, not by recourse to typology or systematized sets of dynamic forces. For economizing purposes we single out topics or facts for special study. The facts are reconstructed by the physician into a dynamic life story with motivations, so as to reproduce as nearly as possible the original evolution of the experiment of nature. The physician's rôle is to determine the modifiability of this material and the assets to be utilized so that the most effective readjustment of the patient's problems may be achieved.

It must be emphasized that treatment depends on understanding of the total dynamics and the dynamics are only obtained by a meticulous review of the individual personal history beginning at

birth. Since every human being has a different biography, therapy must always be an individually modified program.

The focus of our investigation is oriented around the complaint or the symptoms. The patient who confronts us may or may not have his own complaint, but we consider also the complaint of the family and of the environment. Thus the therapist uses the total situation for guidance, not only the material offered in a highly personal physician-patient relationship. The complaint must represent the real reason for the seeking of help, and is not merely the first statement offered, often enough as an irrelevant detail of the more fundamental unrest. The origin and development of the complaint studied chronologically in the total setting constitutes the present illness. The elaboration of the complaint is obtained from the patient or, in uncooperative patients, from responsible individuals in the environment. Much will depend upon the physician's ability to establish collaboration in such a relationship and to create a working basis for exchange of material dependent upon confidence and understanding. The physician, therefore, must be capable himself of a relationship of reliability, understanding without emotional involvement, and scientific detachment. The physician has his responsibility, but, on the other hand, one counts also on the patient's assumption of responsibility and participation in the treatment procedure; for the physician, no more than the patient, is a purely passive agent in the situation. Rapport is important, not alone as words but also when it leads to the implicit and overt changes which spell constructive action. The initial task then is the establishment of confidence based upon the evidence of understanding, the development of security in the treatment procedure, and a guarantee of perspective in the understanding of the total range of the problem.

The complaint then becomes reduced to experimental pathology, where pathology is understood as the presence of imbalance or disharmony of function. Therapy must be adapted to the individual pathology and must avoid any nosological rigidity or adherence to rigid unitary dynamic concepts or techniques. We prefer a natural talking relationship wherein the individual's spontaneity is protected and encouraged, to give freest expression to his own needs. No attempt is made to utilize an exclusive transference relationship, and more than one physician may share the responsi-

bility of therapy. Where material is not easily available, we utilize all the indirect methods for the obtaining of unrecognized or hidden content, including the word association experiment, analysis of dreams and phantasies, Rorschach technique, handwriting analysis and the special method of free association. We prefer, however, the plasticity of a direct conversational relationship, particularly when the physician's skill permits the patient to retain his naturalness, adhering to his own story in his own terms. The wise use of questioning is utilized to help the patient best present his story and to provoke curiosity for the eliciting of further facts. In no sense do we adhere to a rigid question-answer method. The effort is to guide the patient in an orderly presentation of the material, to assist tactfully in the eliciting of highly sensitive topics, and to aid him in the fullest and most effective expression of his story. An orderly procedure is maintained in the systematic gathering of the original story and the mental status, but thereafter the main effort is to give rein to the patient's own spontaneity and natural curiosity. Tact, sensitivity and sometimes silence are effective. The patient's own reticences are always respected and every effort is made to avoid putting him on record and putting him in a position where he need later retract his story. We recognize that forgetting and repression may also be a healing process. Plasticity is preserved in recording the material, which is more frequently done at the time of the interview but may be deferred if the patient's sensitivity demands.

Therapy begins with an equal recognition of that which works, as well as that which works poorly. The aim is to utilize the immediately available assets in a course of action with the plan of ultimately incorporating that which works less well. The goal is toward restoration of spontaneous activity, the re-establishment of the best natural flowing of behavior that the individual is capable of under unhampered circumstances. For purposes of clarity the physician uses a work sheet containing his initial formulation, his later revisions, his statement of the gaps to be explored. Therapy begins with the first interview and includes an initial formulation to the patient which is devised to lead to new action. We try as much as possible at each subsequent interview to sum up the material obtained so that the patient may carry away something

concrete from each discussion, or that he may see the interrelation of the material presented to the total problem. Naturally this is not always possible in every interview. The material presented may have little bearing upon the specific problem or may not be forthcoming at the time of interview. The patient may only revert to it much later in the treatment. The physician's problem, however, is to evaluate the pertinence of the material at discussion to the total problem involved so that the final synthesis may bring about a summing up and reassortment of all the available facts. The initial formulation attempts to use what dynamics are at hand for the patient's own understanding and acceptance. What one tries to do is to see to what extent the patient can give a statement of fact which gives the physician an idea how far the patient is from that which the physician as a normal person can see. Then instead of boldly presenting him with the facts of what constitutes a normal point of view, the physician takes the patient's actual statement and reformulates that in such a form that it comes as close as he or she will be able to digest to that which the physician considers the more perfect formulation. One tries as far as possible to keep the picture and the problem of the patient in mind. The physician has his solution but he has to work with the patient's material and to express it in the terms in which it is given and to offer his help on that basis. In such a manner the patient is likely to get a sense of satisfaction that the physician understands him. He gets also some measure of explanation expressed in his own actual words. The physician must realize that the patient is not likely to understand the correct and psychiatric exposé of things, but he is usually able to understand a formulation of how the problem sizes up medically in the physician's particular orientation as long as one adheres specifically to the material and terms which the patient has himself used. One tries to keep the problem clearly within the realm of his own best knowledge and to formulate it to the best of his common sense and not to get too far beyond what the patient is able to rise to at that particular moment. In such a formulation, the assets to be utilized may be enumerated, the final goal may be hinted at, the gaps in information may be stated frankly, the general plan for the further study of the patient's needs and the steps in procedure may be formulated. Whether in-patient or out-patient, an actual plan of living may

be offered for the period of treatment, wherein a depressed patient, for example, has a day planned in harmony with his retarded capacities.

The work sheet must always remain plastic and be an indication of the physician's developing and expanding curiosity. Gaps are bound to occur. Discussions may bring forth relatively little that is new or pertinent. The physician may have clearly in mind for discussion at a later date items that his medical insight may consider important. The work sheet should give evidence of his own line of reasoning, the directions of his own curiosity, and the status of the developments from week to week of the therapy. At the same time a modified formulation may be necessary for the family, the nurses in charge, or the referring physician that they, too, may be prepared for cooperative action. Clarification of the fundamental disturbance may come through 24-hour hospital observation. We depend not alone upon what the patient says but upon his behavior during the interview or during the 24 hours in hospital; how he meets the actual problems of socialization encountered on the ward, how he responds and acts in situations as they come up from day to day in his actual living.

This initial study should result in the physician's understanding of the pathology. The specific items to be dealt with as the problems of psychiatry can be enumerated relatively simply:

1. What interfunctional imbalances may do along the lines of minor interferences or complaint disorders (the so-called psychoneuroses), the disturbances due to dominating affects and their fixations, and content imbalances, specific disorders of grasp, panics, the developmental feeble-minded and psychopathic deficiencies.
2. What poisons and metabolism and the special organ malfunctions can do to the personality.
3. What leading structural disorders of the brain can produce toward disorganization of psychobiological functioning.

These are the items of a general pathology. In every case we must evaluate the part played by the successive sets of integration, studying them by all means that physiology and general medicine afford with always the inclusion of the person resources, the more or less specific domain of the psychiatrist. In view of the impossibility of making rigid categories, we work with the descriptive

principles of reaction sets or quasi-experimental groups of facts requiring definition in the etiological factors at work. We avoid classifying the person as representing a disease. Our task is to trace the origin of the complaint genetically in past experience and to organize all the available facts of the person as they work dynamically at the moment. We prefer formulation based on traceable fact rather than on inference, and dynamic terms derived from life rather than systematizations.

For practical therapeutic purposes the physician in formulating nature's experiment may choose first to deal with the simplest integrations—physico-chemical, general biological, anatomical, physiological—and to consider the psychobiological adjustment where these are found inadequate for the total problem. Each integrative set is to be studied in its own rights and terms as long as we do not neglect the total organism. Thus anything that promises melioration in the part-functions is utilized for its potential effect on the total functions. Sedatives, pharmacological aids, hydrotherapy, occupational therapy, and consideration of the total balance that constitutes a day's activity may be utilized. Insulin and metrazol shock may force an appeal to the person at a more physiological level of integration. Nor do we hesitate to use hypnosis, persuasion and suggestion, for their more immediate effects upon the symptoms. Actual re-education, particularly in structural defect cases or in the thinking habits of a schizophrenic, may be employed. We accept responsibility for the patient's 24-hour comfort and behavior, not alone for that which takes place during the therapeutic discussion period. We obligate ourselves to provide as much general rest and healthy balance as can be obtained during the actual treatment procedure. A plan of living may be worked out in which we may ask for abstinence in the use of alcohol and drugs. Actual sexual needs and the amount of urge may be better evaluated during periods of sexual abstinence.

There then remains the personal therapy based upon understanding of the individual's own needs, and always dependent on past experience as well as future goals. We begin the study of each patient as a new experiment of nature, without preconceived theories and without the bias of any systematized theories of dynamics. It is here that the patient has the value of ventilation, of sharing past experiences, of desensitization, of reorientation

into more constructive choices and actions. Treatment is active in that it may lead to encouragement toward discussion along specific lines. Periods of rest may be utilized for consolidation of gains and the opportunity for putting into effect the new insight and orientation.

The detailed personal review is accomplished by the means of distributive scrutiny or personality study. The aim here is to trace the origin of the complaint through the component personal facts of the individual make-up. Thus the biography is followed by an intensive study of the pertinent drives and activities, the range and efficacy of the intellectual processes, the extent of participation, and the rôle of the diffuse emotional factors. This is followed by a study of the childhood, family and general social successes and failures, a survey of the life sexual development, the integration within the broader social group, the attitude to future, religion, ethics. The individual personal differences and the similarities and special problems are clarified, and the final resynthesis aims toward a reorganization into more harmonious action. Successes are analyzed as well as failures. Since man lives largely in terms of symbolization, therapy must include understanding of his own personal utilization of symbols as a method of communication either of conscious or less conscious material. This material of relative unawareness may be reactivated by utilization of dreams and fantasies. Thus one attempts evaluation of the multiple factors at work with a determination to see all the factors in their setting and how they contribute to the final problem, with a conviction that in real life one rarely reduces human problems to a single or a specific factor. The patient may be asked to write out this material along the lines of a detailed questionnaire which is available and which is utilized only for purposes of economy of time and for the orderly and systematic review of the total range of the special functions. The material thus obtained is always reviewed with the patient, allowing him to elaborate or to correct, and helping him to sum up pertinent facts in the most helpful perspective. The writing may be dispensed with in favor of personal discussion where the written record does not lead to conciseness and personal clarity. The method permits of a complete survey of the personality structure, doing full justice to every aspect of the make-up

and with the specific purpose of tracing the components to their dynamic foundation in the life experience.

Thus far we have considered the individual alone, but man is integrated also within his family, his group, his community. The therapist owes an obligation not exclusively to the person but also to the total situation. Thus treatment may have to include modification and reorientation of the family, friends, employer, and indeed the community, since they often become vital factors in carrying out the ultimate recommendation for the patient's future growth, as in the follow-up therapy of the schizophrenic patient. Much useful information may be obtained from these sources which may throw light on the individual's problem, may shorten the treatment period, and may lead, in wise hands, to a helpful re-evaluation by the patient of his total problem. They may also serve as checks upon the efficacy of the treatment procedure as well as contributing to the mental hygiene needs that extend beyond the patient himself.

The final goal is the preparation of the patient for constructive action. This must involve restoration of the physiological needs for sleep and rest, the general physical health, and the preparation for productivity in work and recreation. Thus, the final synthesis aims at an active reintegration of the total individual leading to harmony and internal balance. The effectiveness of therapy will likely depend upon the physician's ability to adhere closely to life and to maintain the plasticity of life itself. We are all bound to our past but not necessarily fatally. The final goal is to make certain of that which is acceptable to the patient and physician worked out in terms of mutual consensus. In the final adjustment we recognize the "more or less" along lines of long-term values in which we must recognize the possibilities for constructive growth in action as well as the specific hindrances of past experience.

In offering these general lines of procedure, one is aware that no general rules will fit every specific case. One must be prepared for failures as well as for successes. Incisive therapy may be relatively brief, or protracted for months in cases of uncooperative, resistant or deeply ingrained disturbances. The process of leading the patient out of his difficulties calls for patience, optimism, sincere belief in one's own methods, a determination to see the thing

through, the preparedness to meet setbacks and reversals without losing sight of the constructive end-goal, and the plasticity and imagination to see within the patient the nucleus of that which is closest to normal and still usable.

To sum up, psychobiological therapy must concern itself with every component of personality organization, utilizing leads at any level of integration, recognizing man not only as an individual but as a socially integrated unit, remaining free to work with any methods of general science that offer melioration, committing himself and the patient to a philosophy or way of life which takes into consideration the specific needs and limitations and opportunities within the person.

MIGRAINE EQUIVALENTS.*

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INTRODUCTION.

In the study of migraine various authors have written of the so-called equivalents in such definite fashion that it is surprising to find the topic so neglected in some modern descriptions of migraine. Thus, such authors as Tissot,¹ Gowers,² and Liveing,³ and in more recent times, Moersch,⁴ Brams,⁵ and Thomas and Post,⁶ to mention a few, have described various forms as psychic, abdominal, cardiac and other forms of equivalents.

The subject is worthy of consideration because of the implications of equivalents for theories of the nature of migraine, and also in relation to problems of diagnosis in various branches of medicine where the paroxysmal attacks may suggest organic disorder in the gastrointestinal and other systems. Such study may also help in understanding the relation of migraine to other paroxysmal disorders of the nervous system and contribute to our knowledge of psychosomatic relationships.

DEFINITION.

It is advisable to review the various ways in which the term has been used. We shall use the terms episodic or paroxysmal in preference to the term periodic which is sometimes used in descriptions of migraine.

* Read at the ninety-sixth annual meeting of The American Psychiatric Association, Cincinnati, Ohio, May 20-24, 1940.

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1. The term "equivalent" has been used with reference to *episodic* attacks, different in form from ordinary migrainous spells and apparently replacing them, as convulsive attacks, spells of paroxysmal tachycardia, or periods of transient mental disorder. These may replace the ordinary migrainous spells entirely over a period of time or occur alternately with them.

2. In some reports the term is used to refer to attacks in which there is a relative minimum of ordinary migrainous symptoms and even absence of headache and a predominance of, say sensory symptoms, which may not have been obvious in the migrainous attacks but which do occur more frequently in migraine than is often mentioned. Some writers seem to have these in mind when they speak of abortive attacks of migraine.

3. In the above, the term equivalent refers to *episodic* attacks. But, in a certain proportion of cases, it is found that migrainous attacks cease with the onset of some disorder lasting for weeks or months, as neurodermatitis, phobias, obsessional states or states of a psychotic nature and return when recovery or relief from these conditions takes place.

4. The term may also be applied to cases where the patient, in circumstances that ordinarily and assuredly in their experience precipitate an attack of migraine—or even has beginning symptoms of an attack—shows an emotional outburst in anger or weeping and finds the threatened attack does not ensue or that the beginning symptoms are dissolved.

Although some writers use the term in reference to the third group, this would seem a different usage from the ordinary. These may be equivalents in a more general sense, but would not seem to involve the same processes as the episodic equivalents which show the same general characteristics as migraine attacks in being of a paroxysmal nature and lasting for a period of hours or a day, with a previous and subsequent period of well being.

It should also be mentioned that we are not concerned here with the continued neurotic disorders found in a fair percentage of all migrainous subjects throughout the inter-paroxysmal period in the form of various neuroses, commonly anxiety or obsessional in type.

DESCRIPTION OF THE CASES.

In this paper we shall discuss our findings in a series of 169 patients in whom we found equivalents, using the term in all four senses already mentioned, in 52 subjects, that is, in 30.8 per cent of the total. This figure does not represent the possible frequency of equivalents for several reasons. Thus, some patients were not available for further questioning necessary to get a more complete history of possible equivalents in the past. Also, we do not

TABLE I.
FREQUENCY OF CLASSIC SYMPTOMS OF MIGRAINE.

HEADACHE.	
	Per cent.
Hemicranic	66.5
Local	26.4
General	6.3
	<hr/> 99.2
GASTRO-INTESTINAL DISTURBANCES.	
	Per cent.
Nausea and vomiting.....	65.3
Nausea only	14.2
Vomiting only	3.2
	<hr/> 82.7
VISUAL PHENOMENA.	
	Per cent.
Present	57.5
	<hr/>

know how many others might have shown equivalents had they been observed over a longer period of time. To judge from a more prolonged study of other cases, it seems fair to suggest that others in this series might have shown equivalents if the period of observation had been extended.

In order to justify the diagnosis of migraine in the series, we append Tables I and II showing, first, the frequency of the classic triad in these cases, and second, the frequency of other symptoms which occur frequently in migraine but often are not emphasized in descriptions of the disorder. It should also be said that these

patients were investigated with all the diagnostic facilities of a general hospital, most of them having been referred from other medical clinics only because of our interest in the subject. Further examinations were obtained when necessary to ensure more rigorous exclusion of organic disorder, and especially in relation to the physical factors commonly claimed as causes of migraine. Disorders as eye strain and other forms of physical disorder were rectified whenever indicated.

VARIETIES OF EQUIVALENTS.

In Tables III and IV we have listed the equivalents found. In the cases covered in Table III, the ordinary migrainous attacks ceased with the development of the equivalents and remained absent for a period of months or years during our period of observation, and in some cases had not returned up to the close of this study. We have tabulated them according as they were of an *episodic* or of a continued and lasting nature, and have already referred to the question of using the term equivalent in reference to the latter group. In the cases covered in Table IV, the migrainous attacks continued, but after the onset of the equivalents, were replaced from time to time by the latter, which were episodic in nature and of the same duration as the migrainous attacks, except the phobias, which were of somewhat longer duration.

As we have stated, the number of equivalents reported represents their occurrence during the period of this study and does not indicate the possible frequency of equivalents. This consideration was also mentioned by Moersch⁴ in his study of the psychic equivalents. Thus, it is not possible to make adequate comparisons with the reports of other workers as to the frequency of this or that equivalent or of the frequency of equivalents in general. Furthermore, various writers do not always distinguish clearly, for example, in statements as to phenomena of a mental nature in migraine, when these were equivalents or associated neuroses and psychoses. With regard to our series, we would only comment that the number of what may be regarded as psychic equivalents is small, if we exclude the special group of continued mental states recorded in the second part of Table III as representing a special use of the term equivalent. As to the frequency of convulsive episodes, our figures are low compared with those reported by Walker,⁷ who stated that

TABLE II.
SYMPTOMS OTHER THAN HEADACHE, GASTRO-INTESTINAL
OR VISUAL.

	Per cent.
Special senses	21.1
Paræsthesiæ	25.0
Pain (other than headache)	12.5
Vaso-motor phenomena	15.7
Intellectual disturbances	6.3
Emotional changes	19.5
Other symptoms	7.9
<hr/>	
Total with "accessory" symptoms	60.6

TABLE III.
MIGRAINE "EQUIVALENTS."
I. EQUIVALENTS REPLACING MIGRAINE.

<i>A. Episodic.</i>	
Paræsthesiæ	3
Abdominal crises	6
Convulsive spells	2
Vertiginous spells	3
Bulimia	1
<hr/>	
	15
<i>B. Continued States.</i>	
Neurodermatitis	4
Mental Depression	4
Schizoid state	1
Paranoid state	1
<hr/>	
	10

TABLE IV.
MIGRAINE "EQUIVALENTS."
II. EQUIVALENTS (EPISODIC) ALTERNATING WITH ORDINARY
ATTACKS OF MIGRAINE.

Spells of excitement and confusion	1
Neurodermatitis	1
Pruritus	1
Syncope	1
Bulimia	1
Vertiginous spells	1
Asthma	2
Depression (transient)	2
Paræsthesiæ	3
Phobias	3
Visceral crises (abdominal and cardiac)	7
Emotional spells (anger or weeping)	4
<hr/>	
	27

14 per cent of his migraine cases developed epilepsy, or with those of Ely⁸ who stated that 7.6 per cent of his 104 patients with migraine presented convulsive phenomena. In Table IV, we have mentioned emotional spells as equivalents. This may at first sight seem a special usage of the term, but a record of the facts justifies the claim that insofar as we are discussing conditions that actually replace migrainous attacks, the evidence is clearer and more direct here than in relation to various other equivalents. In these cases the emotional spell was precipitated by objective happenings, and although the reaction was out of proportion to the circumstances, as judged by an observer, it represented their reaction to the situation in terms of their attitudes and feelings.

A question may be asked as to the basis for the diagnosis of these conditions as migraine equivalents. This can only be answered in terms of the clinical history, and especially in the case of episodic equivalents by the recognition that they occur in circumstances that at other times produce ordinary migrainous spells. It cannot be claimed that a favorable response to ergotamine tartrate is of absolute diagnostic value in migraine, but in cases of episodic equivalents where the opportunity was available we did secure relief with ergotamine tartrate, particularly in cases with paroxysmal pain, but no apparent benefit in the continued depressions. As has been stated, the most direct and immediate evidence is to be found when emotional spells as above mentioned supervened.

THE NATURE OF EQUIVALENTS.

We may first ask whether the equivalents are due to the same changes in the nervous system that underlie the ordinary attack of migraine, a question that does not lend itself to discussion in any brief statement. This can be asked with regard to the general dynamics of the nervous processes involved or as to the special parts and processes involved in the various forms. As to the latter, there are obviously differences in intensity in migraine and various of the equivalents and differences in the extensity of the changes involved in the various forms. Thus we have failed to find any electroencephalographic changes of note during migrainous attacks, so that the convulsive equivalents at least would seem dependent on processes different from migraine and the simple equivalents, that

is, insofar as convulsive seizures seem to be invariably associated with electroencephalographic changes. But, as to the general processes involved, we would answer in the positive as to the milder episodic equivalents at least, and thus agree with those whom Riley⁹ quotes as considering "this disturbance (migraine) is a variable symptom-complex with certain common characteristics, rather than a fixed disease entity." As to the influence of various factors on the nervous system such as fatigue, endocrine status at the time and others, these seem operative in the equivalents, and in various paroxysmal disorders of the nervous system as well as migraine, by altering the level of general nervous excitability as to thresholds, sensitivity and intensity.

We will now formulate our ideas as to the nature of migraine and its equivalents. In this general discussion we exclude cases of so-called symptomatic migraine and those cases dependent on the operation of some definable physical process acting directly on the nervous system and producing local changes there, as reported by Dr. Foster Kennedy.¹⁰ All workers are agreed that migrainous subjects have nervous systems with a high degree of sensitivity, described variously as unstable, neuropathic and the like. As a purely physiological issue, we might ask why this excitability is not manifest in over-activity in conduct and action, as well as in sensation and feeling. Theoretically, it might be suggested that the sensitivity is so great that the processes of excitation develop more quickly than the organized effector functions can relieve at the same rate. Observation of some patients indicates that such an explanation may be justified, especially in those who develop migraine or equivalents in immediate response to some obvious *external factor* producing strain or emotion. In those cases the tension aroused reaches a peak rapidly and then "discharges" in the system in the violent fashion that characterizes migraine, as other paroxysmal disorders, which led Liveing to speak of migraine as a "nerve storm."

However, in other cases where the reaction is not immediate, we have to recognize a factor that Thomas spoke of as accumulative and Gowers called an inhibiting process. From our studies on this series of cases and others, we also would stress the rôle of such a factor and see direct evidence of it in migrainous patients when we

study the personality and social reactions. The characteristics of migrainous subjects have been the subject of several studies in recent years, as those of Tourraine and Draper,¹¹ Knopf,¹² Wolff,¹³ and Slight,¹⁴ who have all emphasized such characteristics as strong self-criticism, blocking of emotional expression, meticulousness, perfectionism and the like. Thus, the majority of subjects studied show in their attitudes, reactions and relations a great degree of control, and restraint of free external expression that involves any degree of emotion. This is in contrast to the degree of sensitivity and strength of the emotional potentialities characterizing such subjects, and well expressed in the statements of those who have come to recognize the intensity of their feelings and emotions when they speak of "burning up inside," a phrase well known to those who have interrogated such patients.

Thus, the dynamic situation in migraine can be best expressed by saying there is an imbalance between the processes of excitation and the capacities of the effector system for free and external expression. It may, of course, be suggested that similar considerations as to the general processes involved can also be applied to other paroxysmal disorders of the nervous system, although we do not intend to discuss that question here. We have emphasized the constitutional factor underlying the excitability, and as to the outcome in migraine or equivalents have suggested that in some cases this may be dependent on a quantitative factor as between the rate and degree of excitation and the possibilities of corresponding effector outlet, that is, based on purely physiological characteristics. But, in the majority of cases, we would emphasize the rôle of an inhibiting factor, essentially a resultant of training and social standards, which hinders a degree of freedom of outlet and expression in keeping with the degree of excitability and consequent degrees of tension likely to develop in terms of the constitutional characteristics.

A justification of such considerations can be seen most clearly in the course of events that may occur spontaneously, or in the course of treatment aimed at achieving insight and alteration of the personality. Thus, we would mention those patients, of whom we have given four examples, in whom, with a too sudden realization and acknowledgment of underlying personality attitudes, there was a

tendency to react with emotional outbursts in situations that previously led to migrainous attacks, or which intervened when the symptoms of a beginning attack already in progress were dissolved in the ensuing emotional reaction. Also, in other patients where a more effective therapeutic result was achieved, the changes accompanying a more healthy and balanced mode of life were accompanied by a lessening of the classical symptoms and their replacement by the milder equivalents. On the other hand, we have seen the opposite, namely, when the emotional situation became more difficult, with an ensuing increase in conflict and adjustment, the development of the more severe equivalents and of more lasting conditions as mental depression. Thus, we would suggest that the development and occurrence of equivalents is related to an alteration in the intensity of the nervous processes involved, or to changes in the organization of the affector-effector balance.

A final question may be raised as to what determines the particular equivalents likely to develop in the individual case. From our experience, it appears that all of the minor equivalents may appear from time to time in the same subject. However, there is a specificity of equivalent formation in some subjects that we can only presume to be dependent on constitutional factors. In this regard we face the same problem as confronts us in the study of other disorders, physical and mental, and which, in the case of the neuroses, when considering the particular type or systems involved, we speak of as "choice of organ" and "choice of neurosis."

CONCLUSIONS AND SUMMARY.

1. The importance of migraine equivalents has been indicated with regard to problems of diagnosis in medicine and to the understanding of the nature of migraine.

2. Equivalents may replace migraine entirely and be episodic or continued in form, or may alternate with migraine attacks in episodic form.

3. In a series of 169 migrainous patients, equivalents occurred in 30.8 per cent over the period of observation.

4. The equivalents lend support to the theory that migraine is the result of an imbalance between processes of excitation and capacities for external "discharge." Whereas the former is de-

pendent on constitutional factors, the latter is determined largely by factors of training and experience affecting the organization of the nervous system.

5. Equivalents occur in migraine in relation to alterations in intensity of the nervous processes involved, as dependent on external factors of stress or to changes in the affector-effector balance.

6. The specific form of some equivalents is presumably dependent on constitutional factors.

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WILLIAM McDougall, 1871-1938.

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One of the most human documents ever written is McDougall's autobiographical essay, published in Murchison's "History of Psychology in Autobiography."¹ It is a psychological document, standing in strange contrast to the like contributions of his contemporaries. Instead of giving us merely a chronological account of the major events of his life, however intimately or remotely they may have been associated with the unfolding of his scientific contribution, McDougall lays bare his soul. In profoundly pessimistic tones he reveals his aspirations for psychology, and frankly admits a failure so poignant as to move even his most ardent critics. Other autobiographies in the same volume are cheerful. McDougall's is of such a nature as to lead Professor Yerkes to remark, after reading it, "His life is a major tragedy";² and concerning this comment, Adams adds: "In the strictest sense of tragedy, this is profoundly true. The frustrations of little men with little goals are not the materials of tragedy. McDougall's frustration of his goal—to make a science of psychology—was."²

Deeply as the scientific world regrets the passing of so great a man, the note of pessimism changes to one of enthusiastic admiration when, turning from his own appraisal of success, the magnificence of his contribution is laid bare. That contribution stretches far and wide, making significant impacts not only upon psychology, but also upon psychiatry, education, medicine, biology, social, political and industrial problems, anthropology, philosophy, ethics and religion. Even during his lifetime he exerted a profound influence upon the course of psychiatry, particularly in Britain. It is already clear that he was a potent determiner of a significant trend in psychological history also. As Adams re-

¹ "A History of Psychology in Autobiography," Vol. I, pp. 191-223. Edited by Carl Murchison. (Worcester: Clark University Press, 1930.) McDougall's essay was written in 1928.

² Quoted from Adams, D. K., "William McDougall," *Psychol. Rev.*, Vol. 46, No. I, pp. 1-8. Jan. 1939. See p. 8.

marks: "It is possible that if rewritten in 1938 it (his autobiography) would have been more hopeful. Psychology has come a long way in his direction during the past ten years."³ It is with these positive aspects of his contribution that the present article deals.

I. McDUGALL'S CONTRIBUTION IN GENERAL.

Some indications of the dilemma which confronts anyone attempting to summarize McDougall's work may be found in the complete bibliography furnished by May Smith.⁴ The bare listing is impressive to the point of being embarrassing, comprising, as it does, more than one hundred and seventy titles, representing contributions over a period of more than forty years. The fields involved, and the topics discussed, add considerably to the reviewer's task; for we find anatomical and physiological, anthropological and psychological, ethical and philosophical treatises in profusion. For the moment we can do no better than cite the fact that his first publication bore the title "On the structure of cross-striated muscle"; his last, published just before his death, "The riddle of life." The student must perforce rely upon his own researches into this remarkable literary and scientific labor to summarize what lies between.

Nevertheless, two striking characteristics leap out from the bare bibliography; and from these we may take our cue. The first is the large number of original experimental and fact-finding articles that came from his pen. The second is the unconventional, controversial, rebellious ring of many of his challenges—as, for instance: *Body and Mind—a history and defence of animism*; *Psychical research as a university study*; *The battle of Behaviorism* (and again, *The psychology they teach in New York, in Behaviorism—a battle line*); *An experiment for the testing of the hypothesis of Lamarck*; *The present chaos in psychology and the way out*; *World chaos—the responsibility of science*; *Is America safe for democracy*; and others of like daring and virility. McDougall was not only a great genius, an incredibly compre-

³ Adams, D. K., *loc. cit.*, p. 5.

⁴ Smith, May, "William McDougall: Bibliography." *Character and Personality*. Vol. VII, No. 3, pp. 184-191. March 1939.

hensive scholar, an indefatigable worker, an ardent experimentalist, a keen observer and a brilliant systematist; he was also an outspoken rebel.

Let us briefly consider these two characteristics in turn; for they represent the basis on which the resultant edifice of his contribution was constructed. The scope and nature of McDougall's experimental work has been admirably summarized in an article by Cyril Burt.⁵ This brief tribute from one of his former and internationally eminent students includes reference to his medical studies, regarded even at a very early age as a means, not to the practice of medicine, "but to the exploration of the mental functions of the brain and nervous system"; his psychological tests on natives and his studies of social life among the "pagan tribes of Borneo," in connection with the Cambridge Anthropological Expedition to Torres Straits; his work at Göttingen under G. E. Müller (from whom he appears to have received his experimental inspiration, though he was by no means in sympathy with Müller's outlook for psychology); his founding of, and continued interest in, the first psychological laboratory at University College, London; his ingenious experiments on color-vision; his "desire to formulate a physiological basis for cognitive processes, in terms of an organized hierarchy of nervous arcs, through which the unknown nervous energy ("neurin" as he called it) flowed in a pattern of waves guided by the resistance of the nerve-junctions or synapses";⁶ his experiments at Oxford (where he succeeded Professor Stout as Wilde Reader in mental philosophy) on attention, whence he was led to the "study of more abnormal states in which attention lapsed—hypnosis, suggestion, mental fatigue and intoxication by alcohol and other drugs"; his interest in Galton's work on mental testing and mental heredity, and in the correlational work of Spearman; his own contributions to psychological measurement and his aspirations for widespread practical anthropometrics; his experiments on learning and memory, and later, on the inheritance of acquired characteristics . . . these and other research endeavors, in addition to his important

⁵ Burt, Cyril, "William McDougall: An Appreciation." *Brit. J. Educ. Psychol.*, Vol. IX, Part I, pp. 1-7. Feb. 1939.

⁶ McDougall's first book was the "Primer of Physiological Psychology" (1905), in which mental activity is described from this standpoint.

contributions to social psychology and his theoretical and practical attempt to "bridge the gap between academic psychology and the study of nervous and mental disorders."

In addition to, and perhaps more important than all this, McDougall was constantly making observations, somewhat as Galton did, pertinent to his all-absorbing interest in psychology, wherever he was and whatever he was doing. Consider, for example, his self-imposed task of recording his dreams immediately on waking, his observations of his own pain, and his perpetual use of the writings of others—in biology as well as psychology, in philosophy and science generally—as a source of facts about human behavior and experience. Nor were these widespread observations unrelated or chaotic in nature; for at all times he was a systematist, seeking order in the most diverse phenomena. Adams has called him "the most empirical of systematists," and at the same time "the most systematic of empiricists."⁷ He decried any narrow formulations which applied only to a limited number of facts; hence his opposition to mechanism as a theory of behavior. Nothing was excluded from his considerations if it was observed by himself or by others. He sought constantly for a systematic set of concepts sufficiently comprehensive to include all phenomena pertinent to the science of psychology. Of this tendency we shall have something to say later.

The second characteristic to be considered in this general survey of McDougall's work, is that of being a rebel. He himself repeatedly admits this tendency, as, for instance, when he says: "Whenever I have found a theory widely accepted in the scientific world, and especially when it has acquired something of the nature of a popular dogma among scientists, I have found myself repelled into skepticism."⁸ And he sees it as operating in his early opposition to the sensory theories of Hering, the views of Müller on attention, and the then popular and orthodox psycho-physical parallelism and epiphenomenalism (against which he espoused the cause of interactionism). In the same vein he cites the "spirit of defiance" that led him, once he had become convinced that the mechanistic biology was unsound, to write

⁷ Adams, D. K., *loc. cit.*, p. 3.

⁸ McDougall, W., in "A History of Psychology in Autobiography," I, p. 204.

"Body and Mind" and to give it the subtitle "A History and Defence of Animism," and his distrust of neo-Darwinism or Weismannism. His attack upon hedonism, launched particularly in his "Social Psychology" (1908) and continued in the "Outline of Psychology" (1923), his violent antipathy to behaviorism, his refusal to accept the current out-of-hand condemnation, by science, of psychical research, offer other illustrations.

With frank self-scrutiny, McDougall attributes his rebellious tendency partly to arrogance; but it was more than that. His outlook, once it began to take active form, was perfectly consistent all the way through. Few men of his time were willing or able to apply their fundamental postulates to so many fields, or see the implications of their scientific conclusions in so sweeping a perspective. The elaboration of this point will concern us in the next section.

II. McDOUGALL'S CONTRIBUTION TO PSYCHOLOGY.

It is never possible fully to evaluate a man's contribution to his own field until the history of that field has moved considerably forward in time. A tentative and partial evaluation of McDougall's work may, however, be attempted, for two reasons. First, the point of view which he so forcefully adopted was made plain fairly early in his writings. His later development of that point of view in no way necessitated a change of front. Secondly, McDougall clashed in so uncompromising a manner with his opponents that the present-day decline of mechanistic psychology must to some degree be related to the reality of his position. In any case, the weaknesses of premature evaluation may to some extent be offset if care is exercised in epitomizing the system of thought itself.

McDougall was undoubtedly influenced, very early in his career, by the writings of Lotze. In his "Medicinische Psychologie" (1852) Lotze had emphasized—in harmony with the growing importance of physiology and its findings—that the mind and the nervous system must be studied in relation to one another. At the same time he strove to combat the dangers of current enthusiasm for the unquestionably fascinating physiological discoveries, by contending that physiology was, of itself, completely

inadequate to explain mind. This plea for a psychology, existing in its own right, and having a rôle of paramount importance in illuminating the field of human behavior, made a strong appeal to McDougall; and while other psychologists, notably Bain, made the same plea, its full significance often tended to be lost to view in the comparatively narrow scope of their scientific observations.

This was not the case with McDougall. As we have indicated, the breadth of his purview of human phenomena was unusually great; and this acted in such a way as to keep the fundamental goal ever before him (or perhaps the ardor with which he received Lotze's challenge precluded any contraction of his field of observation). Lotze's realization also of the potentialities, for psychology, of the study of animal behavior, and of abnormal conditions, undoubtedly had a similar influence. Add to all this the teachings of Stout and of James—to both of whom McDougall frankly acknowledged his debt—and we have at least the core of stimulation that made possible the fact that McDougall was probably the first great scientist to spend his whole life in the service of making psychology a separate, distinct and self-subsistent branch of science. For him psychology was no mere philosophical aside; nor was it a temporary half-way-house between popular prejudice and physiological under-pinning. Still less was it to be a localized set of technological aids to some minor sphere of practical endeavor. As he says in his "Outline of Abnormal Psychology," "psychology . . . is destined to be recognized as fundamental to all the human sciences."⁹

Great as was his debt to the writings of Lotze in furnishing him with a significant aspiration for psychology, however, there soon became evident the need for some basis other than that furnished in these writings for interpreting the meaning and purpose of experience. Lotze, in his logical and epistemological contributions, had accepted a dualism between an external reality antecedently given, and the system of ideas shaped by the mind in its efforts to know the original world. This savored too much of intellectualism, and crystallized the mind-body problem in such a way as to be very dangerous. In an eagerness to forsake the

⁹ McDougall, W., "Outline of Abnormal Psychology," Preface, p. xii. (London: Methuen, 1926.)

philosopher's chair for the experimentalist's laboratory, psychology very naturally turned away from dualism expressed in so crude a form, leaving it to those who enjoyed its imponderables; and the natural result was an increase in the liaison between mechanistic biology and so-called psychology. Consequently McDougall saw at once the need for avoiding the mechanistic implications of psycho-physical dualism, parallelism, epiphenomenalism, or any conception that, while paying lip-service to psychology, was at the same time undermining its claims to existence. It was in this sense that he espoused interactionism, and at the same time insisted upon that "irreducible residuum" which mechanism could not explain, but which implied the manifestations of purpose. The very existence of psychology was at stake unless some such conception were feasible and could be established by the methods of empirical science.

But where could he turn for the necessary evidence, for the facts that would illuminate the truly psychological understanding of behavior? He anticipated the inadequacies of any pragmatism that would exclude large regions of behavior; and no doubt he owes much to his association with James in this connection. It was impossible for him to be content with any form of functionalism that, as with Dewey, would turn its back upon the problem of defining a "situation" save in common-sense terms. If "situation" is taken to mean that event or circumstance which is limited, for purposes of experiment, by the laboratory controls, it ultimately leads to mechanism (as was indeed the case with behaviorism). If taken to imply a conveniently segregated unit of behavior, with the understanding that all situations are logically inter-related, it is likely to represent a return to Lotze, or to some form of absolute idealism that makes the significance of a particular human act sink into oblivion. In neither case is psychology likely to survive.

The importance of this problem to McDougall cannot be over-emphasized. Any failure to recognize this fact is to misunderstand his fundamental position. He himself always regarded "Body and Mind" (1911) as his *magnum opus*; for it was here that he set forth his scientific conviction that the brain and nervous system were the instruments of mind, not the mind itself; that mechanism, even when carried to its utmost conceivable limits,

was not enough; that the inner significance of behavior can never be portrayed by intellectualism or structuralism based upon a rôle of the mind's subservience, in experience, to an outer physical world that bombards consciousness, and sets up, in consciousness, the task of bringing order to the resultant sensory impressions; that functionalism as such could lead only to chaotic observation of limitless phenomena unless the essential meaning of function could be made clear; that observation of behavior itself necessitates the postulating of something more than materialistic science was willing to admit.

The basis of the position he eventually adopted was, of course, influenced by his biological background. If mechanism is an untenable postulate for psychology, whether that mechanism is operative between physical reals or mental atoms, then we naturally turn to life itself, which somehow must contain within its very nature the essence of behavior we are seeking. McDougall's own words isolate the significant starting point of his systematic thought: "I seemed to see clearly that, whatever theory of the relation of mind to matter (of the psychophysical relation) one might hold, any psychology that ignored, or failed to bring out clearly, the fundamental purposive nature of mental activity was doomed to sterility. . . . The most essential character of life-processes seemed to be their goal-seeking nature. . . . Where there is life there is mind, or, at least, that form of goal-seeking activity which becomes what we call mind in highly developed organisms."¹⁰

The kind of purposiveness which is involved in the hedonist theory of motivation, he found most inadequate, particularly since it had been "clumsily attached" by so many of the writers of the nineteenth century "to an otherwise thoroughly mechanistic associationism." He therefore "wrote a hormic psychology, of which the keynote is the hormic urge to live, differentiated in the course of biological evolution into the specialized forms that we call instincts. The innate basis of the human mind was thus for me not merely certain reflexes . . . together with a capacity for certain qualities of sensation. I could not follow Lloyd Morgan and his many disciples in supposing that by adding sensations and images to

¹⁰ "A History of Psychology in Autobiography," I, p. 215.

mechanical reflexes we can generate intelligent mental activity. Sensations were to me unreal abstractions; and "ideas" and "concepts" were anathema, the fountain-head of most of the confusion in modern philosophy and psychology. The mind was in some sense a unity from the beginning and developed not by accretion of sensations, images and ideas, but by a process of perpetual differentiation and specialization of its rudimentary powers of knowing, of feeling, of striving towards goals. Psychology must begin by recognizing frankly the peculiar nature of the facts it deals with, and must postpone, indefinitely if need be, the task of reconciling itself with the sciences of the inorganic world."¹¹

There are apparent influences, in all this, of the teachings of Ward, and some unquestionable similarities with the later work of the Gestalters. But these influences and similarities derive their significance from the fact of a common foe—mechanistic associationism—rather than from an identity of systematic bases or outlook. There is, also, nothing incompatible between this teleological view of mind and McDougall's earlier concern with the subject of nervous energy (as in his theory of inhibition by drainage, for example, which he applied to reciprocal inhibitions of the spinal level, inhibitions on the sensory level, the mutual inhibitions of instincts, and many well-known features of the attention process). Indeed, the development of his main thesis came, we are told, from the sweeping assertion, made in a lecture in 1906, "that the energy displayed in every human activity might in principle be traced back to some inborn disposition or instinct."¹² In other words, the meaning, for psychology, of energetic human action must be sought in terms of organismic purpose.

The manner in which this hormic point of view was launched through the publication of his "Introduction to Social Psychology" (1908) is well known to all students of modern thought. Many excellent epitomizations of this—the best known aspect of his work—are to be found in our literature.¹³ Almost equally familiar

¹¹ McDougall, W., *loc. cit.*, pp. 215-6.

¹² *Ibid.*, p. 208.

¹³ See, for example, Spearman, C., "The Life and Work of William McDougall": Character and Personality. Vol. VII, No. 3, March 1939, pp. 175-183, especially pp. 176-181. Also Flugel, J. C., "A Hundred Years of Psychology," Part IV, Chap. VII. (London: Duckworth, 1933.)

to psychologists is the systematic extension of the principles there laid down, published some three years after his acceptance of the chair of psychology at Harvard, and entitled "Outline of Psychology" (1923). This latter volume presented what he felt was a "scheme, more complete than any other, of the general structure or organization of mind, and of the development of that structure from its innate basis,"¹⁴ and established him as the chief opponent of behaviorism.¹⁵

We are not concerned here with the vulnerability of his instinct theory as such, although we shall comment upon some aspects of this later. The usual criticisms of the structure of McDougall's psychology, however, frequently miss the point of his more basic position. It is relatively easy to point to inadequacies in his analysis of human behavior, or to question the validity of his assumption that each instinct is associated uniquely with a single emotion. But the danger in so doing is in losing sight of the systematic outlook of which these details were merely the expression.

The remainder of McDougall's contribution to psychology may be dismissed briefly. Once his outlook is firmly established, specific publications are but further elaborations. Their variety is apparent rather than real; but because they were so frequently regarded apart from their contextual setting in his scheme of thought, they were often received with misgivings. To McDougall, however, the logical extension of his "Social Psychology" in the direction of understanding collective action, was his "Group Mind" (1920), in which he dealt not with a supernatural entity or substance, but with a thoroughly consistent construct (analogous to

¹⁴ McDougall, W., *loc. cit.*, p. 215.

¹⁵ Flugel makes the interesting comment (*op. cit.*, p. 271) that "the two men who have most consistently opposed predominant American tendencies in America—Titchener and McDougall—have been British psychologists, and both went to America from Oxford, largely as a result of the generally antagonistic attitude of this University to psychology." One sees McDougall, during his period at Harvard, as doubly a rebel—since he was outspokenly critical of the American mechanistic trend, and, in writing the preface to his "Outline of Abnormal Psychology" (1926) he could not avoid the comment "I anticipate that at no distant date, perhaps before the end of the century, even the University of Oxford may begin to take an interest in the human mind and may set her hall-mark upon psychology by giving it a recognized place among her studies."

the constructs of Gestalt) to explain group behavior.¹⁶ His lengthy investigations designed to settle the Lamarckian question were received almost with horror, when in reality they were designed with full appreciation of the crucial nature of the Lamarckian hypothesis in the conception of mind as significant in (rather than merely a by-product of) evolution. His openminded interest in psychical research and telepathy, and his tolerance even for the work on extra-sensory perception, are similarly to be understood. We may criticize him for his desire to bring scientific illumination to the very unusual, the frankly mysterious or even the highly doubtful. But his attitude throughout was unassailable.

However this may be, McDougall still stands as a man apart from his contemporaries. This, of course, is more true in America than in Britain, although even the British psychologists failed to understand him as intimately as he would have wished. There were obvious reasons for the aloofness of his contemporaries. Psychologists have become very busy people, given to working in their own grooves; and during the past fifty years their endeavors have become increasingly canalized by the methods of their experimentation. These methods have taken them away from the world of thought that nurtured McDougall in his early years, and have set up the god of objectivity in such guise as to bring widespread scorn upon anything savoring of subjective introspective concepts. At least they did for a time, and a very active time it was. The soul, the substantial mind, even consciousness disappeared. Faculties were taboo, vitalism was discarded, action became reaction, instincts became chain or compound reflexes, and development became a matter of conditioning. Every trend in this rapidly moving scene of energetic enthusiasm for objective experimentation seemed dead against everything McDougall stood for. How could a psychology of orexis survive in laboratories where the very name had no meaning? How could instinctive faculties capture the imagination of students for whom all behavior was reflexive or conditioned? How could a term like the "Group Mind" arouse a receptive attitude when mind even as

¹⁶ In this connection, see Heidbreder, Edna; "William McDougall and Social Psychology." *J. of Abnormal and Social Psychol.*, Vol. 34, No. 2, April 1939, pp. 150-160.

applied to the individual was out-moded? As for animism, and the rest, !

But the picture is not quite complete. McDougall talked very freely about people, human beings—their motives, the complexity of their affective life, their goals, aspirations, attitudes. The terms of popular usage, such as “instinct” and “instinctive” were shown to be inadequate, but were then recast in accordance with the demands of more careful observation of everyday experience. Questions of character development, moral judgment, social desirability, inter-personal relations came naturally within the scope of his analysis and interpretation. Small wonder, therefore, that the theologian, the preacher, the social uplifter, the industrial psychologist, the sociologist saw promise in a scientific attempt to clarify some of the complex issues of modern education and human relationships, obligations, motives and purposes. McDougall's system still remains as an outstanding attempt to bring order into the world of conation and affection, instead of leaving it to the artist, the historian or the sentimentalist; and the widespread popularity of the “Social Psychology” bore witness to the need which he endeavored to supply.

Furthermore, psychology has now found for itself how inadequate any treatment of human behavior is that tries to dispense with some form of purposivism, at least akin to that for which McDougall stood. Measurement of individual differences has done much to clarify the concept of intelligence and the nature of human abilities; but it has also set into bolder relief the “other aspects of personality.” Instincts have been ruled out of court by the objectivists; but prepotent reflexes, appetites, drives, urges, interests, attitudes, tendencies, dispositions, needs, desires, intervening variables, selective mechanisms, vectors a limitless list of constructs has crept back into our various psychologies. We might well take heed of McDougall's conviction that science is advanced more rapidly “by being wrong in so clear a fashion that something got done about it than by being right so vaguely that it had no consequences or testable implications.”¹⁷ In drawing attention to the absence, in psychology as he saw it, of any treatment of the human side of life, he did psychology a great service, however inadequate his own treatment may have been.

¹⁷ Quoted from Adams, D. K., *loc. cit.*, p. 2.

III. McDougall's INFLUENCE ON PSYCHIATRY.

The fact that McDougall's psychology was chiefly concerned with problems of purposes, of motive, in behavior, and with the whole matter of personality structure and development, naturally had a marked influence upon psychiatry, or at least upon those psychiatrists who came into intimate contact with his system. This was probably a more significant factor than any prestige McDougall may have gained by his experience with war neuroses and other abnormal conditions during (or since) the Great War, or his interest in abnormal psychology.¹⁸ As we have seen, the main (or even sole) object of McDougall's life work was to include all data of human behavior within the one systematic framework; and very early he challenged any of his theoretical deductions or hypotheses by recourse to abnormal as well as normal phenomena. But his influence upon psychiatry, where it occurred, was more directly due to two things—the nature of his psychological formulation, on the one hand, and the trend in psychiatry towards the more intimate appreciation of *functional* disorders on the other.

When psychiatry began to doubt seriously the complete adequacy of the equation between disorders of behavior and of bodily structure, and to consider the possibility of functional (and especially of psychogenic) abnormalities, there was little in the way of clarification from systematic psychology. Truly, the abnormalities could be catalogued to some extent in terms of faculties, or the symptoms could be subsumed under the categories of associationism, or again the tricks of experimental psychology might reveal symptom patterns hitherto unobserved, or observed only very crudely. But intellectualistic and sensationistic psychologies were not very promising. The psychiatrist accordingly went his own way, and began to build up systematic formulations of his own. Psychologists have always had a high (but somewhat jealous) regard for such men as Janet, for example.

At that time the tendency among psychologists was to get away from people, and study mental elements or particular re-

¹⁸ This latter phase of McDougall's work is reviewed by Holsopple, J. Q., "William McDougall and Abnormal Psychology," *J. of Abn. and Soc. Psychol.*, Vol. 34, No. 2, pp. 161-165, April 1939.

actions. Their spiritual parents had studied the soul or the mind, or some one or other of its faculties in more or less abstraction. A few, such as the great William James, undoubtedly maintained an intimate contact with the strivings of the human spirit. But James couldn't get along very well with the thought of most of his psychological contemporaries, who seemed to be content with doing funny little things. Even when he stimulated them to think along certain highly practical lines, they tended to run off at tangents the moment they took that stimulation into their laboratories. So he went back to philosophy where things were, to him, more calm, more orderly, more human. James could talk to teachers meaningfully; and teachers even today can derive great profit from what he had to offer. He could interpret some of the most intimate problems and meanderings of the human mind to the intelligent and thoughtful layman. But he couldn't talk so effectively to the psychologist who was beginning to be on the move. James exerted great influence upon such men as Ward; but Ward was more philosopher than psychologist according to the standards of his time (and especially of later days). Ward influenced Stout—but again Stout's philosophic grounding dominated his psychological outlook and inhibited his contribution whenever it moved beyond the field of cognition. Stout's pupil, McDougall, was really the first accredited psychologist to refuse to forsake people for the laboratory, and to demand of the science he represented that it should combine experimental rigor with a central interest in the personal problems of people.

The publication of the "Social Psychology" accordingly aroused an enormous interest among British psychiatrists. This work was more general in its scope than the writings of such people as LeBon (who was very much intrigued with the work of Charcot), Shand, Drever, Tarde, Trotter and others who at about the same time or later were interested in phenomena of suggestion, imitation, emotions and sentiments, crowd behavior and the like. It was the most systematic account of why people behave as they do. The urge, drive, tendency; the emotions and their compounding and organization; the development of sentiments and their organization; harmonious integration and conflict; regression; problems of volition, of character;—these functional constructs and

subjectively interpreted manifestations of the person in action were all there. True, in the main they were based upon observations of normal people, although much anthropological research and observations of many races and tribes were included; and one criterion of emotional simplicity was that of abnormal manifestation. But the scheme lent itself readily to the orderly interpretation of many psychiatric phenomena. Bernard Hart's masterpiece of clear writing, his "Psychology of Insanity,"¹⁹ is more nearly in accord with McDougall's position than with that of Freud, to whom he pays tribute, or of Trotter, on whom he draws in his emphasis on the importance of the herd instinct. Many other British writers in this field show a like influence; and prominent upon the bookshelves of many more practising psychiatrists will be found this, the most well-known, of McDougall's treatises.

McDougall also had a considerable influence in determining the British reaction to the formulations of Freud. There was a great deal of similarity in basic outlook between hormic and psychoanalytic approaches to the meaning and development of behavior tendencies, although the extent to which either system of thought influenced the other is probably very small. The systems diverge radically from one another in their superstructures. But the kinship is sufficiently marked that Burt says: "It was, I imagine, partly because it was so easy to incorporate many of the simpler elements of psychoanalytic doctrine into the theory of mind already expounded by McDougall that psychoanalysis received an immediate sympathetic hearing among academic psychologists in this country" (Great Britain).²⁰ How far this is true of psychiatrists also, is difficult to say. Up to a point McDougall welcomed the teachings of Freud as being in the same direction as his own, at least in their insistence upon the importance of mental dynamics, and of subconscious conflicts in all degrees of functional disorders. But beyond this bare framework the similarity between the two men is more apparent by analogy than real; and Freudians themselves are rarely prone to recognize direct influence from any source save one. McDougall's endorsement of the Freudian ap-

¹⁹ Hart, B., "The Psychology of Insanity." (Cambridge: University Press, 1912.)

²⁰ Burt, C.; *loc. cit.*, p. 6.

proach, however, did much to protect psychoanalysis from attack by psychologists. But his frank criticisms of the inconsistencies of the doctrine led the analysts to view him with a good deal of suspicion.

IV. COMMENT.

The foregoing has attempted a brief account of McDougall's contribution in what seemed to him to be its most positive aspects. A final word may be added somewhat on the negative side, since there are signs in present-day literature that by sympathetically approaching the field of personality as interpreted by him, yet being aware of the significant weaknesses of his treatment, much progress may be expected in the future. Rather than being antagonistic in the sense that the behaviorist was, when he refused to consider McDougall's postulates as worth noticing, writers such as Allport direct their scrutiny to the limitations of his constructs, while honoring his vision as to what psychology's task should be.

The abstractions of a dynamic psychology such as McDougall's tend to lead to logical difficulties, and to serious limitations in their usefulness in everyday practice. Logically, the subdivision of the dynamics of experience into rigidly independent entities makes it almost impossible to treat integrated process without recourse to some mysterious *deus ex machina*. Instincts do not provide a consistent universe of discourse. The single person has become a disunited manifold; and all the king's horses. . . . This is one of the major difficulties of early dynamic psychology in general against which the modern work of Lewin has directed its attack. Then, too, theories of instincts and the consequent stories of integration or conflict tend to be limited to diagnostic or descriptive rôles. A given personality or a particular set of behavior patterns and difficulties are interpreted in terms of innate drives and their complex entanglements due to past experience. Practical action in regard to the person therefore demands some untangling form of analysis—mysterious to the onlooker and the logically minded scientist alike. Such theories therefore make for a clear-cut difference between psychotherapy, on the one hand, and positive education on the other. Positive education is that which accompanies perfectly harmonious development; it ceases to be positive once the person is failing to run along smoothly. This not only

makes for a gulf between therapeutic dynamics and educational endeavors, but also tends to give us a theory of development that describes why the organism goes wrong, from the point of view of mental health, but says nothing tangible about positive function.

Instead, therefore, of setting up abstract constructs to "explain" the dilemmas and difficulties of personal experience, or to "explain" why a given act takes place in a given situation, would it not be better for psychology (and psychiatry too) if our investigations involved working with people and participating with them in their goals and objectives, rather than merely observing their behavior and postulating abstract goals as explanatory constructs? Only in this way are we ever likely to arrive at clear insights into the nature of development from a psychological angle, and to a depicting of development that has continuous and ever enriched mental health as its aim, rather than merely the development of a habit, conflict, neurosis and the like. Only then will the harmony between the efforts of education and positive mental hygiene be possible.

A STUDY OF THE PROBLEM OF MALNUTRITION IN
INSTITUTIONALIZED PSYCHOTIC PATIENTS.*

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The problem of malnutrition in chronic institutionalized psychotic patients has caused considerable difficulty and misunderstanding. Relatives of patients are frequently unable to understand why the patient has not gained weight, and as a result, frequently develop a critical attitude towards the hospital in regard to its food service. In the present inquiry an attempt was made to ascertain the amount of malnutrition present in hospitalized psychotics, as well as to find the causative factors and to determine what measures were necessary to correct this situation.

The weight of the entire hospital population was investigated with the exception of bed patients, or those on the tuberculosis wards or on the acute infirmary service. In this study, the weight at present, weight on admission, age, height, the normal weight and the activity of 1164 patients were examined in an effort to determine the extent of malnutrition. After the magnitude of this problem was determined, a group of patients who were malnourished was treated with a high caloric diet and adequate vitamin and mineral intake, and another group was treated with the same diet with the addition of insulin.

As in all statistical surveys of this type the question of what constituted normal weight was a problem. A table of normal weight for men was adopted from the report of the Medico-Actuarial Mortality Investigation.

Since all of the patients were weighed nude, a standardized deduction of ten pounds from this table was made for the weight of

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clothing. This allowance of ten pounds, being considerably in excess of what would normally be the weight of clothing, would tend to cause a lowering of the standard weight. In addition to securing information of the present weight of the individual and the standard weight, a comparison was also made between the weight on admission and at the time of survey. Patients were further divided

Age, years.	5 ft. 5 ft.	5 ft. 2 in.	5 ft. 4 in.	5 ft. 6 in.	5 ft. 8 in.	5 ft. 10 in.	6 ft.	6 ft. 2 in.
15	107	112	118	126	134	142	152	162
16	109	114	120	128	136	144	154	164
17	111	116	122	130	138	146	156	166
18	113	118	124	132	140	148	158	168
19	115	120	126	134	142	150	160	170
20	117	122	128	136	144	152	161	171
21	118	123	130	138	145	153	162	172
22	119	124	131	139	146	154	163	173
23	120	125	132	140	147	155	164	175
24	121	126	133	141	148	156	165	177
25	122	126	133	141	149	157	167	179
26	123	127	134	142	150	158	168	180
27	124	128	134	142	150	158	169	181
28	125	129	135	143	151	159	170	182
29-30	126	130	136	144	152	160	172	184
31-33	127	131	137	145	154	162	174	186
34-35	128	132	138	146	155	165	176	188
36-37	129	133	139	147	156	166	178	190
38-39	130	134	140	148	157	167	179	192
40-41	131	135	141	149	158	168	180	193
42-43	132	136	142	150	159	169	181	194
44-45	133	137	143	151	160	170	182	195
46-50	134	138	144	152	161	171	183	197
Over 50 ...	135	139	145	153	163	173	184	198

FIG. 1.—Normal Weights for Men.

into four degrees of activity. Those patients doing arduous or active work were designated as "A"; those doing moderately active work as "B"; doing light work as "C"; and those patients totally idle were designated as "D." An attempt was made to correlate the degree of activity with the percentage of malnutrition in each of these groups. The degree of malnutrition was recorded under three different headings: (1) the number and per cent of patients one or more pounds under weight; (2) the number and per cent of

patients ten or more pounds under weight; (3) the number and per cent of patients twenty or more pounds under weight.

This arbitrary division into three separate groups was done because of possible disagreement as to what constitutes normal weight. A further comparison was made between the total number of patients (1) who were under weight when they were admitted and weighed less at time of survey than they did on admission and (2) those patients who were under weight on admission and who had lost ten or more pounds since admission.

Of the 1164 patients, 580 or 49.9 per cent were under weight one or more pounds. Of the same 580 patients, 349 were ten or more pounds under weight and constituted 29.9 per cent of the total patients studied. Likewise in this group of 349 patients, 166 or 14.3 per cent of the total number of patients studied were twenty or more pounds under weight.

Total.	Under-weight.	Undwt. 10 lbs. or more.	Undwt. 20 lbs. or more.	Undwt. on adm.	Undwt. and weigh less than on adm.	Undwt. and lost 10 or more lbs. since adm.
1164 pts.	580 pts.	349 pts.	166 pts.	656 pts.	249 pts.	89 pts.
100%	49.9%	29.9%	14.3%	56.6%	37.9%	13.6%

FIG. 2.—Extent of Malnutrition in Institutionalized Psychotic Patients.

Of the entire group, 656 patients or 56.6 per cent were under weight when they were admitted to the hospital. At the time of survey, 249 patients or 37.9 per cent of this group were under weight when they were admitted to the hospital, and had lost weight since admission; 89 patients or 13.6 per cent of this group were under weight when they were admitted to the hospital and had lost ten or more pounds since admission.

Considerable speculation has always been rife as to whether patients engaged in active occupational therapy were not suffering from malnutrition to a more marked degree than those leading a more sedentary life. A study of Figure 3 will reveal the fact that the least malnutrition occurs in the groups designated "A," doing active work and "D" totally idle; while the highest degree of malnutrition exists consistently in those groups designated "B" and "C," the moderately active and light workers.

A further attempt was made to correlate the degree of malnutrition with the type of service on which the patient was hos-

pitalized. As might be expected, those individuals on the acutely disturbed service showed the highest degree of malnutrition, with those on the infirm service second, and the reconstruction service

	Under-weight.	Undwt. 10 lbs. or more.	Undwt. 20 lbs. or more.	Undwt. on adm.	Undwt. and weigh less than on adm.	Undwt. and lost 10 or more lbs. since adm.
A	92 pts.	52 pts.	26 pts.	107 pts.	44 pts.	21 pts.
197 Pts.	46.7%	26.5%	13.2%	54.3%	41.2%	19.6%
B	202 pts.	119 pts.	52 pts.	224 pts.	86 pts.	27 pts.
383 Pts.	52.7%	31.1%	13.5%	58.5%	38.3%	12.1%
C	171 pts.	115 pts.	56 pts.	187 pts.	69 pts.	29 pts.
333 Pts.	51.3%	34.5%	16.8%	56.1%	36.9%	15.5%
D	115 pts.	63 pts.	32 pts.	138 pts.	50 pts.	12 pts.
251 Pts.	45.8%	25.1%	12.8%	55.0%	36.2%	8.7%

FIG. 3.—Extent of Malnutrition in 1164 Patients. Classified According to Varying Activity. (See Text.)

	Under-weight.	Undwt. 10 lbs. or more.	Undwt. 20 lbs. or more.	Undwt. on adm.	Undwt. and weigh less than on adm.	Undwt. and lost 10 or more lbs. since adm.
Reconstruction Service (660 pts.)	319 pts. 48.4%	168 pts. 25.5%	93 pts. 14.1%	362 pts. 54.8%	14 pts. 38.6%	48 pts. 13%
Infirm service (351 pts.)	173 pts. 49.3%	99 pts. 28.2%	44 pts. 12.5%	200 pts. 57.0%	72 pts. 36%	26 pts. 13%
Acute service (153 pts.)	88 pts. 57.5%	56 pts. 36.6%	28 pts. 18.4%	94 pts. 61.3%	37 pts. 39.4%	10 pts. 10.6%

FIG. 4.—Extent of Malnutrition in 1164 Patients. Classified according to Services. (See Text.)

showing the least malnutrition. Oddly enough, the variation between the several services was strikingly small, thus the extent of malnutrition on the chronic infirm service was not appreciably higher or lower than that on the services where the patient population was in better physical health.

This statistical survey also brought forth the fact that the average height of these 1164 veterans was 66 inches and the average age was 47 years. Computing the caloric requirements based on these averages, a basal caloric requirement of 1580 calories is indicated, and a basal plus 50 per cent diet would have a caloric equivalent of 2370 calories. A study of the regular hospital diet shows that approximately 3700 calories per day are served to the patients (Fig. 5). As this is well in excess of the caloric requirement, it would seem that the serving of food is adequate.

On one of the wards a particular attempt was made to study this problem of malnutrition. Thirty-two individuals who were suffering from marked malnutrition were given a high caloric diet, with a caloric intake of approximately 4500 to 4700 calories a day. They were also given close dietary supervision and if food was refused in whole or part, the equivalent of the refused food was tube-fed. With these means and with a high degree of personal supervision, the caloric intake of this group was assured. In addition to this, the group was given from 15 to 25 units of insulin at 10:30 in the morning and at 3:30 in the afternoon. A second group of similar size and with equal severity of malnutrition was also given a high caloric diet of 4500 to 4700 calories per day, with extreme personal supervision of the diet and with the tube-feeding of the equivalent of food the patient refused to eat or left on his plate. In each group a more than adequate supply of vitamins and minerals was assured by brewer's yeast, cod liver oil, vitamin B-1, and by a balanced diet.

The treatment of malnutrition in these two groups of patients was continued for approximately twenty weeks, and the results of this treatment can be seen in Figure 6. From this chart it is evident that at the end of twenty weeks the average gain in weight of those patients receiving insulin and a high caloric diet was approximately 27 pounds, while the average gain in weight of those patients receiving the high caloric diet alone was approximately four pounds.

SUMMARY.

A statistical survey of the problem of malnutrition in chronic psychotic patients reveals the fact that 49.9 per cent of all the patients in the hospital weighed less than the normal weight as out-

150 Stew
133 Whea
170 Milk-
58g Hot c
& bu
175 Coffee

150 Fruit
100 Prepa
170 Milk-
100 Eggs
175 Coffee

100 Banan
100 Whea
170 Milk-
225 Bacon
300 Bread
175 Coffee

150 Grape
150 Homi
170 Milk-
100 Eggs
175 Coffee

150 Stew
133 Whea
170 Milk-
58g Hot c
175 Coffee

200 Stew
200 Rolle
170 Milk-
100 Eggs
175 Coffee

50 Toma
100 Whea
170 Milk-
58g Hot c
175 Coffee

SUNDAY.		
<i>Breakfast.</i>		
150 Stewed peaches	150 Soup—crackers	300 Cold meats & cheese
133 Wheat cereal	320 Baked ham	250 Escalloped potatoes
170 Milk—sugar	200 Mashed potatoes	35 Pickles
585 Hot cakes w/syrup & butter	125 Buttered rutabagas	285 Bread—butter
175 Coffee w/sugar & cream	25 Tomato relish	100 Blackberries
	285 Bread—butter	200 Marble cake
	250 Ice cream w/straw. sauce	200 Cocoa
	175 Coffee w/sugar & cream	
<i>Dinner.</i>		
		(4113)
MONDAY.		
<i>Luncheon.</i>		
150 Fruit compote	500 Spaghetti w/meat see.	350 Pot roast beef—gravy
100 Prepared rice	150 Head lettuce salad	200 Mashed potatoes
170 Milk—sugar	w/Fr. drsg.	175 Glazed carrots
100 Eggs w/bread—butter	325 Corn bread—butter—jam	35 Cucumber relish
175 Coffee w/sugar & cream	185 Pear halves	285 Bread—butter
	200 Cocoa	200 Butterfly rolls
		125 Tea w/sugar & milk
		(3610)
<i>Dinner.</i>		
TUESDAY.		
100 Bananas	400 Esc. ham w/potatoes	150 Soup—crackers
100 Wheat flakes	150 Red cabbage salad	200 Broiled liver
170 Milk—sugar	285 Bread—butter	200 Whipped potatoes
225 Bacon	250 Pineapple ice cream	175 Fried onions
300 Bread—apple butter	200 Cocoa	50 Beet relish
175 Coffee w/cream & sugar		285 Bread—butter
		200 Apple cake
		125 Tea w/sugar & milk
		(3740)
WEDNESDAY.		
150 Grapefruit w/sugar	300 Bean soup—crackers	350 Steaks—gravy
150 Hominy	150 Fruit salad	200 Mashed potatoes
170 Milk—sugar	285 Bread—butter	150 Baked squash w/butter
100 Eggs w/bread—butter	400 Wh. cream puffs	35 Relish
175 Coffee w/sugar & cream	200 Cocoa	285 Bread—butter
		150 Neapolitan gelatine
		125 Tea w/sugar & milk
		(3660)
THURSDAY.		
150 Stewed apricots	450 Fr. scrapple w/cream gravy	150 Soup—crackers
133 Wheat cream cereal	150 Boiled rice	400 Lamb w/mix. veg. & potatoes
170 Milk—sugar	150 Apple salad	35 Cucumber pickles
585 Hot cakes w/syrup & butter	285 Bread—butter	285 Bread—butter
175 Coffee w/cream & sugar	250 Grapenut ice cream	250 Pineapple tapioca
	200 Cocoa	125 Tea w/sugar & milk
		(3943)
FRIDAY.		
200 Stewed prunes	300 Crabmeat salad	175 Fillet of haddock
200 Rolled oats	300 Fr. fried potatoes	200 Mashed potatoes
170 Milk—sugar	35 Relish	100 Stewed tomatoes w/butter
100 Eggs w/bread—butter	285 Bread—butter	285 Bread—butter
175 Coffee w/cream & sugar	200 Hot cross buns	265 Bread pudding—sauce
	200 Cocoa	125 Tea w/sugar & milk
		(3600)
SATURDAY.		
50 Tomato juice	400 Baked beans, catsup	225 Hamburger cakes
100 Wheat flakes	150 Fruit salad	200 Mashed potatoes
170 Milk—sugar	285 Bread—butter	100 String beans w/butter
585 Hot cakes w/syrup & butter	300 Boiled coconut layer cake	285 Bread—butter
175 Coffee w/cream & sugar	200 Cocoa	250 Chocolate pudding—vanilla sauce
		125 Tea w/sugar & milk
		(3600)

FIG. 5.—Typical Regular Diet for One Week, with Caloric Values.

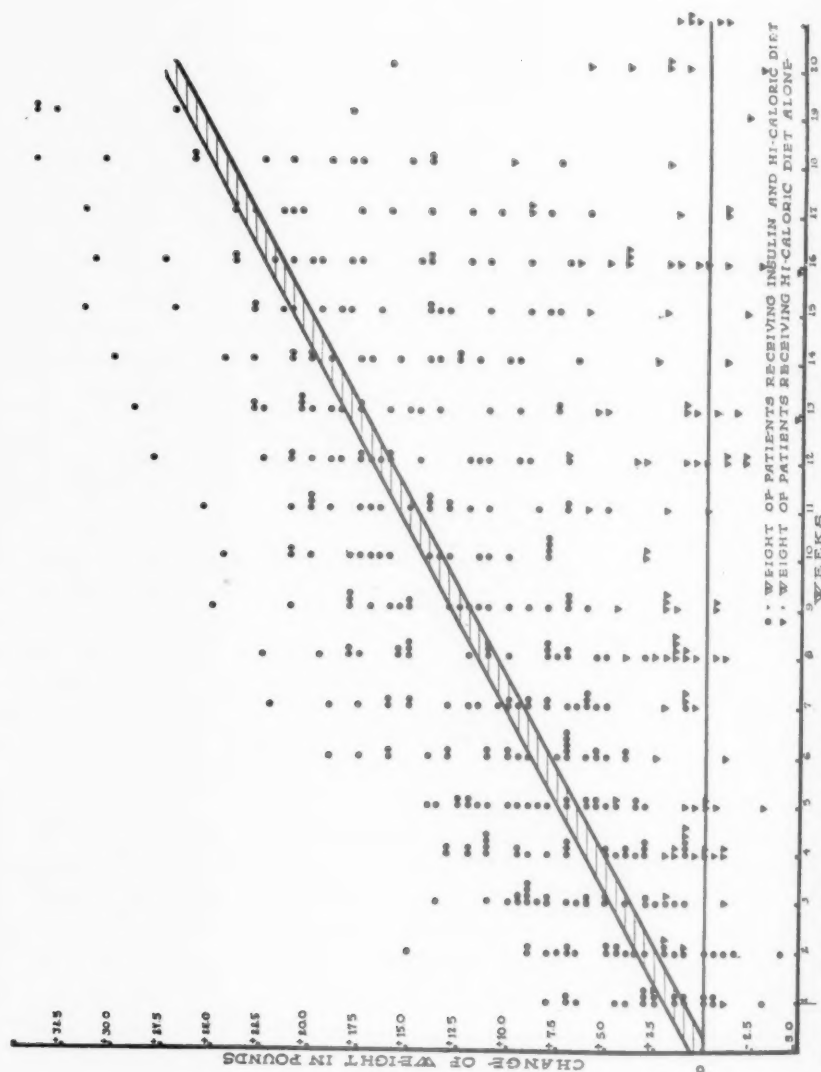


Fig. 6.—Chart Showing Gain or Loss of Weight Following Two Methods of Treatment for Malnutrition.

lined by the report of the Medico-Actuarial Mortality Investigation. Approximately 30 per cent were ten or more pounds under weight and 14.3 per cent were twenty or more pounds under weight. Almost 57 per cent of the patients were under weight when they were admitted to the hospital, and further, 38 per cent of these have lost weight since admission. Likewise, 13.6 per cent of the patients were under weight when they were admitted and have lost ten or more pounds since that time. This rather staggering amount of malnutrition is present in a hospital where the caloric value of the diet exceeds "basal diet plus 50 per cent" caloric requirement by 56 per cent. Under carefully controlled conditions a group of patients was given a high caloric diet with conditions so controlled as to assure the intake of at least 4500 calories. Despite the administration of this amount of food, a large number of these patients failed to gain, and the average gain was less than four pounds over a period of twenty weeks. A like group was given the same dietary intake and in addition 15 to 25 units of insulin twice a day. This group of patients underwent a gain averaging approximately 27 pounds in twenty weeks.

It must further be noted that while 56.6 per cent of all patients were under weight at time of admission, 49.9 per cent were under weight at the time of this survey.

Several of the patients who received insulin for the treatment of malnutrition had striking and unexpected improvements in their psychoses.

CONCLUSIONS.

1. Malnutrition in institutionalized psychotic patients is a problem of great magnitude.
2. Contrary to popular belief, a considerable portion of the patients do not gain weight after admission to the hospital.
3. The feeding of more than 4000 calories per day, accompanied by high vitamin intake, is not followed by uniform weight gain.
4. There is some inherent factor lacking in the digestion, absorption, or metabolism of psychotic patients which requires something in addition to adequate caloric intake for gain in weight.
5. Whatever this factor may be, it appears to be supplied when insulin is injected.

6. With the exception of the acutely disturbed section, there was little difference between the extent of malnutrition on the various wards.

7. The energy expended in active occupational therapy did not appear to influence significantly the extent of malnutrition.

8. Further studies on a much larger group of patients are indicated, with particular emphasis on possible correlation between extent of malnutrition and type of psychoses.

IDEAS OF CONTAMINATION AS DEFENSE AGAINST SEXUALITY.*

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Patients who have beliefs that some infection or contamination exists about their persons present varying degrees of involvement. The psychoneurotic who suspects that his food is poorly digested and that his constipation causes what he calls "autointoxication" is perhaps the mildest type. His idea that there are toxic or deleterious substances within himself may occupy but a small part of his interest and attention and does not come within the scope of the present discussion.

Such a case, it is true, introduces the conception of noxious influences of some physico-chemical nature, but it differs in one important respect from the group to be described, namely in the degree and type of emotional involvement. In the above instance, there is relative freedom from any associated moralistic feeling tone such as is characteristic of those who believe that they suffer with a taint, a defilement or a pollution which has changed their previous state of purity or cleanliness to one of impurity, with corresponding regret and chagrin.

Such patients may have some real condition of which they complain, such as cancer or syphilis or tapeworm. It is the quality of their thinking, the sort of ideational content and the coloring of their affective reactions to the believed status however which is characteristic of the group. We find that they themselves sometimes form connections between their ideas of contamination and their own erotic life, either actual or desired, as in the following instance:

Case I came of a well-educated family, graduated from college, and became a personnel manager in which work he was efficient until he developed a

* Read at the twenty-ninth annual meeting of the American Psychopathological Association, Atlantic City, New Jersey, June 5-6, 1939.

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paranoid psychosis at 51. He had always been shy and had very narrow interests so that it was hard for him to make friends. Years earlier he had become engaged, but had felt that he was so inferior and specifically that he would probably be such a failure sexually, that he broke his engagement on trivial grounds. While he disclaimed any such attraction, he was uneasy lest his great interest in boys might seem to others an indication of homosexuality. At 41 he developed an acute arthritis. It disappeared when focal infections of teeth and tonsils were removed, but he was convinced that it had been caused by childhood autoerotism. When 51 he had rectal pain, due to an inflamed crypt of Morgagni. At the same time he had an infected finger. He rapidly grew perturbed and thought his entire arm was infected and that medicine given him had been doped, that is, that the doctor was making him a drug addict. He constantly demanded enemata and rectal examinations. On admission to hospital, his rectal condition had recovered and physical examination revealed little except a strikingly feminine distribution of pubic and body hair growth. For years he believed that he was being drugged; that he would be castrated; that he was being forced to a false confession of homosexuality. He thought people accused him of being luetic and taunted him for not having married.

Of note in this case are these points: This man had a feminine constitutional predisposition with patent homosexual drives about which he had always felt guilty, as he also had about any sexual attempt whether autoerotic or heterosexual. He regarded himself as sexually inferior and when physical infections occurred he associated them with his sex problem, explicitly stating that for these phenomena his guilty sex acts were the cause. Likewise, he consciously associated the doping and persecutions with homosexuality. Yet he did not recognize how his delusions symbolized a passive homosexual reception of his persecuting seducers. It seems that his life course had prepared tensions which were released when the involuntional accenting of his erotic drives became associated with a physical inflammation of that same bodily area.

In this typical instance what actually lay just behind the scenes has appeared before the curtain in a form which is but little altered. By the elimination of few details and the emphasizing of certain others very closely allied in the patient's conceptions of things, the transposition has been accomplished. From the original constellation, which includes sex instinct, homosexuality, rectum, men doing things to him, producing effects on him, addiction to a habit regarded as unacceptable yet compellingly craved, defensive protestation, and active seeking of attention from men, not a single item

has totally disappeared. Instead of the chief emphasis and interest being placed upon the notion of a form of sexuality, this has been replaced by the notion of a form of contamination, and the latter theme is then responded to in such a way as the former one might have been.

In such cases ideas of contamination serve the function of substitutes for a desired form of sexuality to which the personality will not grant recognition as such. Other cases make use of similar ideas as a protection against sexuality which is actually not desired, as in the following instance:

Case II was a married man who developed an acute resentful delusional psychosis at the age of 29. He had been an industrious, over-conscientious person who worked his way through college, graduating at 24 to become a telephone engineer. He had felt close to older men but was ill-at-ease and shy with the opposite sex. He was quite prudish. When he married at 26 he was exceedingly jealous of his wife, refusing to allow her to have anything to do with any other man. Then, as before, he showed no sex interest. Once he attempted marital relationship but failed, and in the ensuing six years never repeated the effort. He stated the following reasons, all untrue: that his wife did not wish relations, that intercourse was only for propagation and she did not want children, and that he had phimosis requiring delay until an operation be done. But he never sought remedy of this fancied condition. When he had pneumonia at 29, he began to hear voices accusing him of homosexual practices and he sometimes struck men who he thought had said such things. He grew upset because he thought his wife had poisoned him and he feared death. In hospital he complained of numbness and poor circulation due to this poisoning by his wife. He insisted that the topic of sex ought not to be discussed. He was violent in his hatred and disgust for homosexuality.

Physical examination revealed feminine hair and fat distribution and an atrophic testicle but was otherwise not significant. He said that his marriage had been his greatest mistake in life. He felt sex was unnecessary and dirty. He was happy and at ease with his men friends but was made dizzy, tense and irritable by the poisons his wife gave him when he was with her.

The obvious homosexuality of this patient seemed not to be the situation hardest for him to cope with. It was the constant pressure of normal heterosexuality for which he was constitutionally and psychologically unfitted which was his chief burden. This became even more difficult when, following a physical illness, his natural homosexuality became more vigorous. While he would not recognize and admit this, he was able to cope with it better than with the utterly unacceptable normal pattern. Hence he expressed

himself as contaminated not by the accusing men, but by his silent wife.

These preoccupations with distress over infections and the like seem not necessarily to signify socially unacceptable forms of sexuality, but they are sometimes found in what seems a defense against sexuality in general. All that appears to be a prerequisite is that the instinct is vigorous enough in its drive and that the individual has, for his own personal reasons, a sufficiently strong desire to repress its identity.

Case III was handicapped by a broken leg at the age of three years, which resulted in a permanent ankylosis of the hip and shortening of the leg. It interfered with play and he stayed much at home except when in classrooms. He grew up to be serious-minded, idealistic and perfectionistic. Everything was done meticulously. He decided that his deformity would make marriage unfair, resolved never to marry, and so never made a date with a girl in his life. He conscientiously refused to yield to autoerotic temptations. Upon graduation from dental college at 24, he began a successful practice, but did much charity work, gave freely and disliked to send out bills, with the result that he never made much money. Very careful to avoid infection or contamination in his work, he resterilized his instruments again and again, washed his hands excessively and made total changes of clothing daily. He had no infection in 23 years of dental surgery. When 47 he had influenza for five days. On his fourth day back in the office a pleased young woman patient playfully kissed his cheek. He immediately grew preoccupied and anxious. He feared he had contracted syphilis and would now be in danger of infecting others. He washed his hands so much and sterilized his instruments so incessantly that he had to abandon his practice. Although he had taken no initiative in the momentary kiss, he now feared he was losing his soul. In a mental hospital he remained depressed and feared he was contaminating others. He said: "If I could just get rid of the idea of infecting and doing harm, I'd be all right. I like to be perfect. I've tried to live very straight. I've never had intercourse or anything like that—of course I've never married. I've been highly respected all my life. I'd rather have cancer than to worry the way I'm doing." He believed people thought him to be a sexually active and unscrupulous man.

The patient's life-long, successful inhibition and control of his erotism, having been threatened by the stimulation of an amorous incident, has had to increase its defenses. At the same time the aroused instinctive drive seeks some gratification. The resulting compromise is a replacement of the sex picture by a contamination picture as shown by its use of the notions of a venereal infective activity, of the relationship and transmission ideas, and of the delu-

sional phantasy that people think him to be quite active sexually. On the other hand, the notion of infection still serves as an adequate medium of expression for the customary reactions of his personality to such phenomena. Here we find intense guilt with agitation; self-punishment revealed in his depression and alarm; the description of some taint in himself which is powerful, dangerous, filthy and capable of involving other persons. There is however a certain mitigation for the patient's discomfiture: he does not feel himself responsible for what has happened; it has been put upon him. From his life-long training this patient was accustomed to think much of the rights of society. Accordingly he was unable to overlook the distressing effects of his own supposed condition upon others.

There is an opportunity in the case of contamination ideas for carrying out two kinds of defense. The patient who is distressed over a horrible detriment to his physiological normalcy has thus protectively absorbed a large part of his attention in ways which prevent its turning towards erotism as such. And if the material on which concern is now focussed can also contain or symbolize parts of the original erotic aim, the economy as well as the gratification of the method is heightened.

It is interesting therefore to consider in what way ideas of infection and contamination are able, as the cases cited show they are, to substitute effectively for sexual ideas. In other words we may ask what associations the mind forms between ideas of sexuality and ideas of contamination. Hence, we must pause to consider the principles of the associative function.

A mental concept, while formed from a great number of elements, usually brings only a few of the chief determining items into awareness. Which of the remaining items may be admitted to consciousness will depend on the surrounding situation and upon the pressures of one's urges and inhibitions. The recognized identity of a particular concept is determined not by the individual component elements but by the general quality or configuration of their grouping. To illustrate,—if we see a word misspelled there is little difficulty in reading it aright because the number of correct elements gives such a strong hint to the probably correct total. Again, a person seen in the distance at dusk may be recognized

if enough familiar detail is observable. At a greater distance one may be able to recognize merely a person, or only a moving object. These grades of clarity of concept formation indicate merely the completeness of awareness of the details by the observer.

The mental concept which the observer can form is dependent upon the number and the clarity of details available to his consciousness. From long experience the mind has acquired a facility for supplying enough "probably correct" details in an incompletely experienced situation to give a more or less well-rounded concept of the situation. Indeed, it is difficult *not* to read completion into incompletely recognized experience. In hearing a companion's conversation on the street, for instance, one may not be aware that perhaps only half of the actually spoken syllables were heard above the noise, for he has supplied from his previous experience enough presumably appropriate padding to make sense to his comprehension. In so doing, he may of course be entirely mistaken. It seems likely that this is the kind of process which accounts for the difference between the Freudian "latent content" and the "manifest content" of dream material.

Suppose now that one seeks to give attention to his concepts relating to sexuality and that his prejudices, resistances or conditionings succeed in blotting out from the conscious horizon certain of the details of the concepts concerned. The mental situation will then be similar to that of the observer peering through the dusk at an object. If the inhibition of essential definitive elements is sufficiently slight, the individual may be able to recognize that the total group of elements actually does betoken a sexual notion. But if more of the specifying details are blurred, then the supplying of "probably correct" supplementary details may produce not the actual concept but some similar notion containing many of the same items, yet with a different totality, thus producing a different conscious concept.

It is suggested then that ideas of contamination may occur in psychosis due to a process of faulty completion of concepts whose original identity has been blurred by the removal of some of their definitive items by repression. As a result of this withdrawal of detail the mind finds itself confronted with an insufficiency of data which it proceeds to supplement with the most plausible available

material. The result, it is true, is a concept, a notion, or a series of notions. But the original concept, through disintegration and re-synthesis under emotional pressure, shows now a changed identity. Much of the original quality may be retained, because many of the original items are still included in the new concept, but what was needed to make it recognizable as referring to sexuality may no longer be free for identification.

In general it seems that if from a group of details which in summation lead to a particular conception certain detail is withdrawn, then one of two results will occur. Either the less restricting, less rigorously defining data will form a larger, vaguer, more generalized concept; or else assumedly relevant and correct supplementation will occur. In the latter case, the addition of more particulars will allow a more specific and definite concept to be produced, but the accuracy of this new concept will hinge upon the correctness of the supplied material. If it is accurate and reliable, so may be the new concept; if it is erroneous, the concept will be also.

When a gap is to be filled from the reserve notions in the mind, it is preeminently the different pressures of one's wishes which determine what elements obtain preferences from among those with possible associational linkages. It follows that if at such a juncture there is a strong wishful pressure active against certain details and towards certain others, the choice of matter to be used in supplementing an impoverished concept will be correspondingly affected. And in turn this means that the resulting new concept will be delusional in proportion as one's wishes diverge from the facts of reality. This depends upon the degree to which the cravings remain ungratified.

If, on the other hand, the person is willing to accept the concept, that is, does not too strongly need to supplement with padding, there need be no delusion formation, for if to the facts no subjective wish-fathered matter be added, there remain only factual data and reality can be maintained. The price to be paid for it is, however, that only a more generalized, more non-specific concept is then possible, and if carried too far this tendency leads to ever-widening concepts with less and less practical realism.

From such considerations as the above it appears that when one has severe conflicts over his sexuality one of the possibilities of reac-

tion is to replace the sex topic with the notion of infection, contamination, poison and the like and that the process involved in achieving this substitution may be described in terms of concept formation. The alterations of concepts as a result of wishful thinking to form delusions conforming roughly to the same general pattern have been pictured. In detailing the process, it appears that with some of today's social-cultural attitudes concerning sex and with some of its medical and bacteriological aspects, contamination ideas offer a particularly parallel conception which can be substituted with certain very definite dynamic advantages even at the expense of reality.

CONSEQUENCES OF METRAZOL SHOCK THERAPY.*

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AND

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The indiscriminate use of a dramatic treatment during the early period of its application, is an unavoidable correlate of enthusiasm and ignorance. Elgin entered whole-heartedly into the adventure of metrazol shock-therapy and indulges in no vain regrets upon this account.

In our experience this therapy is not a direct menace to life, since no deaths have occurred as the immediate result of thousands of induced seizures. Though a number of long bone fractures have occurred, only one patient in the series to be reported is now invalided upon this account (a hip fracture). Various announcements in 1938-1939 concerning upper dorsal compression fractures of the vertebræ led us to sample our own treated cases, with most disturbing results. Some patients have developed pulmonary tuberculosis, and others hypertension and myocardial damage.

Also, we have demonstrated that in rabbits metrazol in certain dosages produces severe brain changes, and that in patients dead from other causes, but carefully checked against material obtained from subjects dead from similar causes, four out of six showed active astroglial changes in the Ammon's horn region and pre-frontal areas.

During the past three years it has become increasingly evident to us that insulin shock-therapy is generally preferable in schizophrenia, although some cases resistant to insulin shock yield later to metrazol treatment. Upon the other hand we consider convulsive shock a most useful agent in affective disorders such as manic-depressive depressions, the depressive agitations of later life, and not infrequently in chronic, or very acute, manic states.

* Read at the ninety-sixth annual meeting of The American Psychiatric Association, Cincinnati, Ohio, May 20-24, 1940.

In order to determine whether the continued use of metrazol, or any other form of convulsive shock therapy, is warranted in view of the possible resultant damage, the Elgin staff recently undertook a survey of all schizophrenic patients out of treatment at least twelve months, who had not had insulin, and who were still in the hospital, or with whom contact could be made. Questionnaires setting forth required data were filled out by various staff members, working in teams upon three obvious lines of inquiry—the general physical, neurological and psychiatric condition of each

TABLE I.

METRAZOL DOSAGE AS RELATED TO RESULTS.
(Each figure is the median total dosage in grams.)

Sex.	Physical.*		Neurological.*	
	—	o	—	o
Men	15.9	14.6	20.0	14.9
Women	7.5	9.0	7.9	8.8
Total	13.2	11.2	8.9	11.2

* None improved except for weight gains.

(Symbol — indicates damage; o unchanged; + improvement.)

Sex.	Psychiatric.			Psychological.		
	—	o	+	—	o	+
Men	20.0	15.5	12.8	13.8	13.1	14.1
Women	8.8	8.7	11.7	13.0	15.0	8.9
Total	16.3	11.1	12.5	13.3	13.8	12.3

patient relative to his pre-treatment status. Thus each patient was examined in one way or another by six physicians.

Our psychology department had already applied a battery of tests to many of these patients before treatment and repeated 112 of these examinations at the time of this survey.

One hundred and forty-six men and 174 women were thus examined, including 39 men and women who were out of the hospital, but who returned for the complete examination. Because this latter group is incomplete, the general tables do not accurately present the psychiatric data, although they indicate definite trends. A separate statement of the psychiatric results in patients out of the institution will be presented.

Total case dosage ranged from 4 grams (4 cases) to 55.86 grams (9 cases); the median was 19.1 grams. The median dosage for men physically damaged was 15.9 grams as against 14.6 grams for those not damaged—a relatively small difference. A reversed and insignificant difference applies to the women as well, at median dosages of 7.5 grams and 9.0 respectively. The percentage of those who suffered apparent neurological damage was small, but there is some indication of greater damage following higher dosages, of which more later. Only 5 patients were thought to be mentally worse as a possible result of treatment.

TABLE II.

AGE WHEN TREATED WITH METRAZOL AS RELATED TO RESULTS.

(Each figure is the median age when treated.)

Sex.	Physical.		Neurological.	
	—	o	—	o
Men	28.1	28.8	34.3	28.4
Women	30.3	30.9	32.2	30.9
Total	28.9	30.1	33.1	29.6

(Symbol — indicates damage; o unchanged; + improvement.)

Sex.	Psychiatric.			Psychological.		
	—	o	+	—	o	+
Men	36.0	29.4	27.2	28.5	31.5	27.2
Women	33.5	31.7	27.4	26.0	29.0	33.5
Total	33.5	30.6	27.3	27.7	30.3	28.5

This median age of men when treated was practically the same for those physically damaged as for those undamaged. And the same is true for the women. Those thought to be neurologically or psychiatrically injured were several years older than those unchanged or improved, but these groups were far too small for statistical purposes (11 and 5 respectively—5 per cent combined). The group of out-patients who had been paroled or discharged, and returned for complete examination (39), was too small for separate tabulation. Only 2 (men) were thought to be damaged (hypertension in both cases).

THE DAMAGE DONE.

Fifty-one patients were thought to be worse at the time of the survey than before treatment, 27 men and 24 women.

The most obvious form of damage occurred as pulmonary tuberculosis. Two hundred and seventy-seven patients (277) were fluoroscoped during the survey (all that were sufficiently cooperative) and 5 were discovered with minimal findings. From time to time following treatment and before this survey the clinical diagnosis had been confirmed in 20 others, thus giving us 25 patients in all, 18 men and 7 women, who developed tuberculosis after receiving metrazol. The median age was 29 years; median institutional residence 47 months. Seven died before the survey was made, their ages ranging from 18 to 33 years and total dosage from 1.5 to 50 grams. Usually the infection was fulminating in type; duration from 2 months to 1 year. *One patient, known to be an open case, was treated with the approval of our tuberculosis consultant and made an excellent mental and physical recovery.*

Thus, of all patients treated, 8.3 per cent subsequently developed pulmonary tuberculosis, as compared with an incidence of 3.0 per cent in our schizophrenic population over a period of three years—exclusive of those treated with metrazol. If, for the sake of argument, we concede that 20 per cent of these patients would have developed tuberculosis without the intermediation of metrazol, the discrepancy in percentages still remains striking. Further comment would be highly speculative.

Evidence of "possible," "probable," or "unquestionable"—we quote the radiologist's descriptive terms—spinal compression fracture was present in 20 out of 130 vertebral x-rays, representing 15.3 per cent of all those we have thus examined, regardless of psychosis. During the survey 25 cases of kyphosis or scoliosis in the thoracic region were x-rayed, of which 5 (20 per cent) showed evidence of fracture. Of 22 patients who complained of back-pains only one (4.5 per cent) had apparently suffered a fracture. In a recent series of 50 cases checked before and after treatment, this injury has not occurred in a single instance—and a number of these patients were men and women over 50 years of age. We use no drugs, merely hold the patient firmly upon a sand-bed.

TABLE III.

GENERAL RESULTS OF METRAZOL THERAPY SURVEY.

BY NUMBER OF CASES.

(Symbol — indicates damage; o unchanged; + improvement.)

Sex.	N.	Physical.			Neurological.		
		Uncoop.	—	o	Uncoop.	—	o
Men	146	2	21	123	5	4	137
Women	174	8	12	154	6	9	159
Total	320	10	33	277	11	13	296

Physical and neurological improvements were inconsequential.

BY PER CENT OF CASES.

Sex.	%	Physical.			Neurological.		
		Uncoop.	—	o	Uncoop.	—	o
Men	100	1.4	14.4	84.2	3.4	2.8	93.8
Women	100	4.6	6.9	88.5	3.4	5.2	91.4
Total	100	3.1	10.3	86.6	3.4	4.1	92.5

TABLE IV.

GENERAL RESULTS OF METRAZOL THERAPY SURVEY.

BY NUMBER OF CASES.

(Symbol — indicates damage; o unchanged; + improvement.)

Sex.	N.	Psychiatric.			Psychological.		
		—	o	+	—	o	+
Men	146	2	110	34	5	23	42
Women	174	3	155	16	1	20	21
Total	320	5	265	50	6	43	63

BY PER CENT OF CASES.

Sex.	%	Psychiatric.			Psychological.		
		—	o	+	—	o	+
Men	100	1.4	75.3	23.3	7.1	32.9	60.0
Women	100	1.7	89.1	9.2	2.4	47.6	50.0
Total	100	1.6	82.8	15.6	5.4	38.4	56.2

Few definite complaints of leg pains were obtained and no disabling deformities have developed (Kümmel's disease). However, 3 patients treated in 1937 are now an inch shorter than when admitted, and one of these has a compression fracture (of the 7th dorsal). We have used a brace in only one case.

Hypertension plus cardiac hypertrophy appeared in 5 cases following treatment; hypertension with no other complication in nine. In only 2 cases, however, was it noted soon after treatment. Cardiac decompensation required interruption of treatment in 5 patients, only one of whom now has EKG evidence of myocardosis. Of 15 cases with EKG findings previously negative and found to be positive a few months after treatment, 5 now show such changes as reduced and inverted T waves, S-T deviation, slurring and notching of the R complexes. Of 71 cases without previous control there now appears to be right axis deviation in 34 per cent, left in 18 per cent, T wave changes in 18 per cent. However, in 83 per cent of these same cases the findings are essentially compatible with the normal.

Four patients have suffered one to three late epileptiform seizures. Electroencephalograms of 20 patients who had received a total metrazol dosage of 20 to 48 grams showed in 13 cases interruptions of fast frequency waves of the frontal area by delta waves of high amplitude. Characteristic spindles, as seen in grand-mal epilepsy, were present in one patient (the other 3 for one reason and another could not be examined) who suffered spontaneous epileptic attacks after cessation of treatment. These indications of brain damage require further study.

Neurological damage was exceedingly difficult to evaluate; inconclusive findings apparently present when the patient was examined at one time were not elicited at another—such as pupillary changes, difference in plantar reflexes, tremor, suggestions of undue rigidity, adiadokokinesia, and difference in the deep reflexes upon the two sides. All we can well say is that among the patients who had received higher total dosage (20 to 50 grams) there were more of these findings, subject to doubt, however, on account of basically catatonic tension states.

To the best of our knowledge, no patients suffered intracranial accidents, nor were mensurable memory losses apparent.

SUBJECTIVE ESTIMATES OF EFFECTS OF TREATMENT.

Two hundred and eighty-nine patients were asked their opinion as to the results of their treatment. The questions were leading, but an effort was made not to influence replies. A relatively small number (8 per cent) of complaints directly concerned the patient's opinion of the effects of his treatment. Twenty-eight per cent (28 per cent) complained of "pain"—9 per cent in the back, 14 per cent in the arms and legs, and 5 per cent in other locations.

Among the out-patients from whom statements were obtained by way of questionnaires, the great majority said they felt well physically, had no back-pains and were better, or were at least as good as before treatment. Such relatives as made statements concerning these out-patients conceded in only 4 cases that memory was anything but good.

As an evident but imponderable damaging effect of this therapy we have recognized a quite inevitable tendency to eclipse other time-tried modes of treatment in the thought of the psychiatrist, no doubt at times to the patients' detriment. Also, in the case of those with a long duration of psychosis, physicians, after discarding thought of shock-therapy, may neglect the careful consideration of other possibilities. This "damage," too, undoubtedly occurs at times in the case of patients who have failed to respond to the more dramatic treatments, and are subsequently shelved, so to speak.

IMPROVEMENT.

As previously stated, it should be understood that we are not vitally concerned here with the mental improvement made by schizophrenics; we deal with the subject now merely as it presents itself in the general review of their present status.

Of the total number treated (386), 112 are now out of the hospital (25 per cent of all those treated) and of these 30 men and 9 women were seen by members of the staff, who considered 25 men and 9 women to be improved—improvement implying a markedly increased ability to adjust socially. Comparatively few are in complete remission.

Sixty-five out-patients were reached by letter or by social service workers using a questionnaire. Of these only 10 men and 8

women were considered to be improved. Adding to the above the 16 patients still in the hospital, though materially improved, we arrive at a 17.6 percentage of good improvement in the entire group—somewhat less than that of “spontaneous” improvements as variously reported. Attention, however, must be called to the fact that a majority of our cases of short duration were treated with insulin while a preponderance of old cases were being treated with metrazol during the period covered by the survey.

Tabulation of the relationship of duration of psychosis to results of treatment merely confirmed the expected, in that those

TABLE V.

DURATION OF PSYCHOSIS PRECEDING METRAZOL THERAPY AS RELATED TO PSYCHIATRIC RESULTS.

(Per cents of patients in and out of hospital of the entire group.)

Duration.	Psychiatric Result.					
	-		o		+	
	In.	Out.	In.	Out.	In.	Out.
0-6 mo.	0		1.4	6.8	0	16.5
7-18 mo.	0.7		6.4	7.8	0.7	10.7
1½-3 yr.	0.3	None.	19.9	13.6	1.8	13.6
4-6 yr.	0.3		29.1	15.5	2.5	4.8
7-10 yr.	0		14.6	1.0	0.7	3.9
10+ yr.	0.3		20.9	4.8	0.3	1.0
Median	2.3	....	5.3	2.6	4.4	1.4

who had been ill less than 3 years, and were decidedly improved, constituted 43.3 per cent of this especial group. Upon the other hand, the percentage of improvement in the group with a psychosis duration of over 3 years was only 13.2. The median pre-treatment duration of psychosis of all patients improved and now out of the hospital was about 17 months.

After the sixth month of illness no significant correlation between total dosage and duration of psychosis appears. As was to be expected, few patients improved who received the heroic amounts given in our earlier efforts to accomplish the impossible. As was to be expected the greatest percentage of psychiatric improvements occurred in the age groups between 21 and 40.

A larger percentage of patients showed improvement by psychological tests than were considered improved on psychiatric examination. The psychiatrists' estimates were made on the behavior of the patient as a complete unit while the psychological tests were devised to measure certain specific factors—changes in intellectual functioning and in social attitude and rapport *in the test situation*. The high correlation between improvement in test scores and that in "rapport" ratings following therapy, is not always reflected in the total reaction of these patients to the hospital situation.

The pre-psychotic personality, as best this could be evaluated from our records, seems to bear little relationship to improvement; and the same is true of the onset, whether insidious or rapid. We realize, however, that these are only rough estimates, based upon inadequate information and doubtless distorted by a considerable percentage of patients with an indeterminate type of schizophrenia and/or a non-determinable period of onset.

SUMMARY AND CONCLUSIONS.

Some 320 schizophrenic patients—so diagnosed to the best of our ability—were surveyed physically, neurologically and psychiatrically at least twelve months after the completion of their treatment, in order to establish in so far as possible just what are the risks involved in metrazol shock-therapy. Fifty-one patients in all were thought to show present damage, some of which "damage" might very possibly have occurred without the intervention of this treatment. The evident damages suffered were for the most part confined to three large groups.

Vertebral fractures were numerous in the past, possibly 20-30 per cent. However, 50 patients checked after their treatment in 1940 show no fractures. Our inquiry indicates that thus far at least, spinal compression fractures, though highly undesirable, have not proved to be serious complications.

Pulmonary tuberculosis developed in 25 patients, 8 per cent of all those treated, as contrasted with a 3.0 per cent incidence in non-metrazol-treated schizophrenics during the same period.

Myocardial damage and a tendency to hypertension occurred in a relatively small number of patients.

Defects of memory were not obvious enough to be reported upon.

Clinical evidences of damage to the central nervous system were suggestive but questionable. Elsewhere in the literature we have presented histological evidence of brain damage in experimental animals and in human subjects following the use of metrazol. To the best of our knowledge, no intracranial accidents occurred.

The percentage of mental improvements obtained, including those in out-patients reported upon by social workers, was less than that claimed for "spontaneous" remissions. However, more than 43 per cent of those with a psychosis duration of less than 3 years had improved greatly, whereas in the group of longer duration only 13.2 per cent improved.

Many patients showed improvement by psychological tests who apparently had not improved in adjustment to their life-situation as a whole.

We realize that many of the findings discussed in this report represent conclusions rather than facts, and that upon the whole trends are indicated rather than exact data.

As a result of this investigation, the Elgin staff feels justified in the use of metrazol convulsive shock-therapy—principally in the frankly affective disorders—after careful consideration in each case of possible resultant damage as related to the possibility of improvement.

NITROUS OXIDE ANOXIA IN THE TREATMENT OF SCHIZOPHRENIA.*

REPORT OF 24 CASES.

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HISTORY.

Various forms of anoxia in the treatment of schizophrenia have been reported in the literature in recent years. In 1928, Zador¹ reported the use of nitrous oxide and oxygen for the purpose of studying the reaction of psychotic patients as compared with normal persons. In 1929, Loevenhart, Lorenz and Waters² reported their work on cerebral stimulation by the inhalation of mixtures of carbon dioxide and oxygen. Further work along this line has been reported by various authors.³⁻⁹

Since the advent of the hypoglycemic and metrazol treatments, there have been intensive physiological and bio-chemical studies made in an attempt to explain the beneficial results of these methods. Some workers suggest that the chief mechanism for their clinical effects is the cerebral anoxia.^{10, 11} Gellhorn¹¹ recommends a combination of hypoglycemia and inhalation of gas mixtures poor in oxygen.

Himwich and his co-workers^{12, 13} have recently reported their work on the use of nitrogen to produce acute anoxia in the treatment of schizophrenia and in their series of 12 cases have noted encouraging results. Similar work has been reported from England by Frazer and Reitmann,¹⁴ but in their 4 cases they were unable to observe any clinical benefits.

After several months of preliminary experimentation with the method by one of us (E. J. F.), we have now completed treating a series of 24 schizophrenic patients with anoxia induced by the inhalation of nitrous oxide.

* We are indebted to Dr. Robert H. Israel, superintendent of the Warren State Hospital and to Dr. Leonard Rosenzweig, clinical director, as well as to the other members of the hospital staff, for their aid and co-operation during this investigation.

MATERIAL.

An attempt was made to have two groups of schizophrenic patients; one of recent, acute cases and a second group of chronic disturbed ones. Our series contains 10 patients whose illness was of one year or less in duration. Table I summarizes the data of this study. All patients were presented before the entire staff for

TABLE I.

Pt.	Sex.	Age.	Type.	Duration.	No. tr.	Clinical results.
1	M	30	Paranoid	1 mo.	34	Improved
2	M	21	Simple	1½ mos.	27	Remission
3	M	20	Catatonic	2½ mos.	35	Much improved
4	F	21	Catatonic	3 mos.	36	Improved
5	F	32	Paranoid	4 mos.	24	Unchanged
6	M	22	Catatonic	5½ mos.	30	Unchanged
7	M	26	Simple	6 mos.	32	Remission
8	F	33	Simple	10 mos.	36	Remission
9	F	20	Hebeph.	10 mos.	27	Unchanged
10	F	23	Hebeph.	1 yr.	33	Much improved
11	M	25	Simple	1 yr. 2 mos.	26	Improved
12	M	19	Simple	1 yr. 3 mos.	35	Remission
13	F	22	Catatonic	1 yr. 4 mos.	35	Unchanged
14	M	28	Paranoid	2 yrs.	35	Much improved
15	M	24	Simple	2½ yrs.	35	Much improved
16	F	27	Paranoid	3 yrs.	10	Unchanged
17	M	19	Simple	3 yrs.	35	Improved
18	M	30	Paranoid	3½ yrs.	35	Unchanged
19	F	31	Paranoid	4 yrs.	36	Unchanged
20	F	41	Paranoid	4½ yrs.	35	Unchanged
21	F	32	Unclass.	6½ yrs.	32	Unchanged
22	M	20	Hebeph.	10 yrs.	35	Unchanged
23	F	40	Catatonic	11 yrs.	31	Unchanged
24	F	26	Unclass.	12 yrs.	16	Unchanged

diagnosis, and the Statistical Manual of the National Committee for Mental Hygiene was followed in classifying them. Improved patients were again presented before the staff after treatment was concluded, in order to make the evaluation of results as objective as possible. No attempt to break down our results according to the diagnostic types has been made, as the series is too small.

Each case was given a careful physical and neurological examination to rule out organic lesions, especially with reference to the cardiovascular system. Exertion tests and an electrocardio-

gram were obtained. Any damage to the cardiovascular system would exclude a patient from treatment by anoxia.

TECHNIQUE.

The patient should have nothing by mouth for three hours preceding the treatment. T. P. R. should be normal. All sedatives should have been withdrawn as these mask the signs of anoxia, especially the respiratory effects. The patient should empty the bowel and bladder before treatment to prevent incontinence. Most of our patients were ambulatory and before and after treatment they were engaged in the usual hospital régime including occupational and recreational activities. The acutely disturbed patients were brought to the treatment room in a dry pack, which was undone as soon as the patient was past the stage of excitement. Every effort was made to obtain the patient's co-operation. Most of the patients look forward to the treatment because of the pleasant exhilaration which they experience; and even patients who were resistive at the start, very quickly became cooperative. Only two patients in our series expressed any fear or apprehension after the initial treatment.

The administration of the gas was in the hands of a qualified physician. The Heidbrink nitrous oxide oxygen machine was used. An emergency tray with tongue clamp, air-way, a sterile hypo set, with adrenalin, coramine and other stimulants were kept at hand. Another physician was in constant attendance to record the pulse and to make observations of the patients' reactions. Two nurses were also present to hold the patient during the period of psychomotor excitement.

With the patient on the table, the mask is applied and nitrous oxide delivered at the rate of 90 gal. per minute. After breathing pure nitrous oxide for 1-2 minutes, the patient begins to lose consciousness. Just before consciousness is lost there is frequently a short period of cerebral stimulation when the patient will laugh or sing, and may exhibit general motor restlessness.

At this stage, the respiration gradually increases in rate, with slight diminution in depth. Coincidentally with this there is always a rapid increase in pulse rate, and the systolic blood pressure is found to increase 50 to 100 mm. At this phase cyanosis is deepen-

ing and myoclonic twitchings are becoming prominent in the facial muscles, in the fingers and hands. Ankle clonus is found at this time.

Immediately following this phase, the period of marked cerebral anoxia sets in. The pupils become fixed, corneal reflex is absent. Athetoid and myoclonic movements of the hands and forearms are more marked, and are followed by generalized extensor spasm. This is especially prominent in the feet, which assume the equinus position. Frequently the legs are flexed at the knee, or the whole body is held in the opisthotonic position.

We are now approaching the limit to which the anoxia can be carried. The respiration becomes labored especially the expiratory phase and phonation usually occurs. The pupils are widely dilated, and there is a strabismus usually in the direction of the turned head. There is usually profuse perspiration and often increased salivation, and not infrequently incontinence of urine or feces. The pulse is rapid and may become weak and thready; occasionally marked slowing may occur at this point.

Immediately after the onset of rigidity, the bout is terminated by flooding the mask with pure oxygen. At this stage the breathing is extremely labored and if the bout is not terminated immediately, apnea is apt to occur. On a few occasions artificial respiration was resorted to, but normal respiration returned promptly after three or four inspirations of oxygen.

Always after flooding the lungs with oxygen, there is a temporary apnea. The cyanosis disappears very rapidly. There is a very rapid fall in pulse rate, usually to below the normal basal level for the individual patient. The blood pressure returns much more slowly and may not reach its initial level for 5-10 minutes after termination of the bout. Consciousness returns promptly usually within one minute, and with its return there is a period of cerebral stimulation, when the patient feels mild euphoria. The period of cerebral stimulation is of very short duration. Occasionally a patient will feel slight nausea or complain of a headache, which passes off after a few minutes; in one case the headache lasted four or five hours.

In a few of our cases where the respirations were inclined to be shallow, we have administered 2-3 gal. per minute of carbon

dioxide along with the nitrous oxide. The head should be hyperextended to keep the air passageway free.

RESULTS.

Table II shows the results in our series of 24 cases of schizophrenia, grouped according to the duration of illness before treatment.

In the group whose illness was 1 year or less in duration there were 10 cases with 70 per cent remissions or improvement; in the six cases whose illness was of 2-5 years duration, the results were less satisfactory; in the chronic group whose illness was over 5 years in duration, there was no improvement in our 4 cases.

TABLE II.

Duration.	No.	Remission.		Much improved.		Improved.		Unchanged.	
		No.	%.	No.	%.	No.	%.	No.	%.
1 yr. or less..	10	3	30%	2	20%	2	20%	3	30%
1-2 yrs.	4	1	25%	1	25%	1	25%	1	25%
2-5 yrs.	6	0	0	1	16.6%	1	16.6%	4	66.6%
Over 5 yrs.....	4	0	0	0	0	0	0	4	100%

DISCUSSION.

From our results we feel that nitrous oxide anoxia is of value in the treatment of early cases of schizophrenia. In those cases whose illness was less than two years duration our results compare favorably with those obtained by insulin hypoglycemia. However, our results show that it is of little or no value in chronic disturbed cases.

In the hands of a skilled anaesthetist, we feel that it is a relatively safe procedure, because the bout can be terminated rapidly. The danger of paralysis of the respiratory center must be kept in mind. However, with the apparatus adapted to quick inflation of the lungs with oxygen and because of the rapidity with which nitrous oxide is eliminated from the body¹⁵ we feel that this danger can be easily controlled.

The danger of producing irreversible changes in the cerebral cortex must also be born in mind. Cerebral damage following nitrous oxide-oxygen anaesthesia has been reported by various

authors.¹⁶⁻²⁰ From the experimental work of Gildea and Cobb²¹ and Heymans and his co-workers,²² it has been shown that short periods of cerebral anemia produce permanent injury to the cortex. With this in mind, we do not allow the individual treatment to last more than 5 minutes from the onset of the signs of anoxia.

The reactions in our patients corroborate the work of Alexander and Himwich,¹³ in that the reaction of the individual patient is remarkably constant from day to day; but varies somewhat between different patients. The phenomena we have observed appear to us to be identical with those described by them although they state that in the cases which they treated with nitrous oxide, the signs and symptoms differed quantitatively if not qualitatively. We can not say as to the quantitative difference as we have not used pure nitrogen; but since the reaction is somewhat different, both qualitatively and quantitatively, in each individual patient, we doubt the validity of comparing the two gases. None of our cases showed the post-treatment confusion reported by them, although we have noted the transitory nausea and headache in three cases.

Electrocardiograms were taken on our cases before treatment and immediately after the termination of the bout. We are indebted to Dr. J. T. Valone, consulting cardiologist of the hospital, for the interpretation of the electrocardiographic findings. He found temporary arrhythmias due to myocardial anoxemia but in no case was there any evidence of permanent damage.

One great advantage of the anoxia treatment as compared with the hypoglycemic treatment is the greater number of cases that can be treated in a day. Allowing 15 min. per patient, which is more than most require, two physicians and two nurses can treat 32 or more cases in a day. Much less of the patient's time is consumed and he can engage in the regular hospital routine. Our patients were treated five days a week, and we arbitrarily set 36 as the maximum number of treatments per patients. The cost of the gases used averages approximately \$4.00 per patient for the entire course, which makes it much less expensive than insulin treatment.

Another advantage of this form of treatment is that it might be used in a general hospital for treating early cases of schizophrenia, inasmuch as it could be administered by any skilled

anæsthetist and does not require a period of training in the method as do the metrazol and hypoglycemic techniques.

In those patients who showed improvement, it was generally noted after 10-20 treatments. In two of our chronic disturbed patients the treatment had to be discontinued before the course was completed. One of these failed to show any of the usual signs of anoxia. This patient would breathe perfectly quietly, becoming mildly cyanotic, then the respirations would become more and more shallow until she would suddenly stop breathing, without any signs of neuromuscular excitation. The other patient would hyperventilate and then suddenly go into the last phase and it was felt she was a poor risk.

CONCLUSIONS.

1. Nitrous oxide anoxia has given good results in the treatment of early cases of schizophrenia.

2. Chronic cases, whose illness was over 2 years in duration were unchanged.

3. It is a relatively safe method in the hands of a skilled anæsthetist. The dangers of respiratory failure and irreversible damage to the brain must be remembered.

4. Nitrous oxide anoxia is less time consuming than hypoglycemia, and therefore is available to a larger group of patients.

5. The treatment is less strenuous on the patient and most of them enjoy the daily bout.

6. No accidents or untoward effects have been experienced in our series.

7. Whereas the number of cases treated so far is too small to have much statistical validity, we feel that our results are sufficiently good to warrant treating early cases by this method first. If they fail to improve after a fair trial, they can be transferred to insulin treatment.

8. This technique might be used in general hospitals in treating early cases of schizophrenia.

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FURTHER EXPERIENCES WITH PICROTOXIN AS A CONVULSANT IN THE TREATMENT OF MENTAL ILLNESSES.

A METHOD OF COMBINING PICROTOXIN WITH METRAZOL.*

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In a previous paper¹ the use of picrotoxin as a therapeutic convulsant was recommended because it does not produce the terror incidental to the administration of metrazol. At present, we have concluded treatment in 102 patients without any instance of terror or marked fear attending the injection of the drug. Fifty-seven of the patients were classified as schizophrenias, 17 as belonging to a group of "other psychoses," associated with psychopathic personality, mental deficiency or metabolic disturbances, 20 as manic depressive and 8 as "without psychosis."

SEX, AGE AND DURATION OF DISEASE PRIOR TO ADMISSION.

The group of patients was composed of 40 men and 62 women (Table 1). The schizophrenic patients, with an average age of 30.1 years and an average duration of the disease prior to admission of 29.2 months may be considered relatively unfavorable from the viewpoint of treatment.

RATES OF RECOVERY.

The therapeutic results are not as favorable as those given in the original report. There, the schizophrenic patients had a re-

*From the Psychiatric Institute (H. Douglas Singer, Director) of the Research and Educational Hospitals, the University of Illinois College of Medicine.

The picrotoxin was furnished by Ely Lilly & Company.

¹Low, A. A.: Blaurock, M. F.; Sachs, M.; Wade, C.; Ross, E.: Picrotoxin as a convulsant in treatment of certain mental illnesses. Arch. Neurol. and Psychiatr., 41: 747, (April) 1939.

TABLE 1.
DISTRIBUTION ACCORDING TO SEX, AGE, DURATION OF DISEASE AND RESULTS OF TREATMENT OF
ONE HUNDRED AND TWO PATIENTS.

	Number of patients.		Age on admission. Years.	Duration of disease prior to admission. Months.	Results of treatment.					
	Men.	Women.			Full recoveries.		Social recoveries.		Improved.	
					No.	%.	No.	%.	No.	%.
Schizophrenias	26	31	30.1	29.2	9	15.8	5	8.8	14	24.6
Manic-depressive psychoses	5	15	33.7	....	11	55.0	3	15.0	2	10.0
Other psychoses	5	12	28.9	16.4	5	29.4	2	11.8	4	23.5
Patients without psychosis	4	4	31.5	....	4	50.0	2	25.0	2	25.0
Totals	40	62			29	28.4	12	11.8	22	21.6
									39	38.2

covery rate of 26.3 per cent and the patients with "other psychoses" one of 57.1 per cent; in the present series, the corresponding figures are 15.8 and 29.4. The larger number of cases and the longer period of observation which are the basis of this report explain the discrepancy. Two of the schizophrenic patients previously reported as recovered relapsed. One of them was given a subsequent course of insulin therapy and remitted again. Of the group of patients who were treated after the first report was given 4 relapsed. One of them was classified as schizophrenic, 2 as manic depressive, 1 as "without psychosis." On the other hand, 14 patients who did not respond to picrotoxin were subsequently given courses of insulin, some of them an additional course of pyrexia and made good recoveries. Of the total of 41 fully or socially recovered patients, 7 retained their health to date for a period of over 18 months, 13 for over one year, 15 for more than 6 months, 6 for less than 6 months.

COMBINING PICROTOXIN WITH METRAZOL.

Picrotoxin offers three main advantages: (1) the absence of fear for the injection of the drug, (2) relative, and sometimes absolute amnesia for what happens after the injection, (3) the possibility of injecting the drug slowly which makes it available for patients with narrow veins. Its disadvantages are (1) the long interval between injection and convulsion, requiring close supervision, sometimes for more than one hour, (2) the frequency of multiple convulsions which do not seem to enhance the curative effect and may be dangerous, as pointed out in our previous report,¹ (3) the nausea and vomiting which are a rather common feature, particularly if the paroxysm does not take place within about twenty minutes of the injection. It occurred to us that if a small dose of metrazol were given fifteen or twenty minutes after the injection of picrotoxin the advantages might be retained and the disadvantages eliminated. Subsequent experience justified the expectation. When, in summer 1939, a number of patients were given the combined picrotoxin-metrazol treatment, the multiple convulsions were almost eliminated and nausea and vomiting became a rarity. Heretofore, when picrotoxin alone was given, atropine and hysoscin had to be administered routinely by the

hypodermic route, about half an hour before treatment. Today, this premedication has been dispensed with, except in those few instances in which patients became nauseated shortly after the injection of the picrotoxin. Of the present series of 102 patients, 64 were given the combined treatment, with a total of close to 900 injections. There were only two instances of multiple convulsions and only occasional incidence of nausea and vomiting.

TECHNIQUE OF COMBINED TREATMENT.

As a rule, the metrazol was administered twenty minutes after the injection of picrotoxin. However, if twitches developed and increased in frequency the interval between the two injections was reduced, on a subsequent treatment day, to ten to fifteen minutes. It happened occasionally that a convulsion occurred within such a short time that the subsequent administration of metrazol was unnecessary. The initial dose of picrotoxin was 3 cc. containing 9 milligrams of the substance, for women, and 4 cc. containing 12 milligrams, for men. The subsequent dose of metrazol was then 2 cc. of a 10 per cent citrated solution. If violent twitches, confusion or marked drowsiness were noted in the interval between the two injections this was taken as a sign of a progressively decreasing convulsive threshold, and 1 cc. only of metrazol was injected. If none of the signs of a lowered convulsive threshold appeared fifteen or twenty minutes after the administration of the picrotoxin this was regarded as an indication of tolerance to the drug and as calling for a corresponding increase in dosage of from 0.5 to 1 cc. on the following treatment day. As the picrotoxin was increased the dose of metrazol was correspondingly raised in the ratio of approximately two parts of picrotoxin to one part of metrazol. Thus, when the dose of picrotoxin gradually rose to 6 cc. the amount of metrazol injected was 3 cc. In a few patients only was it necessary to increase the picrotoxin to 8 cc. and the metrazol to 4 cc. In one instance only were the doses of the two drugs raised to 9 and 4.5 cc. respectively. None of the patients showed signs of marked fear or terror on being given the metrazol injection. However, occasionally a patient reported, on subsequent questioning, that he experienced the second injection as shock. The dose of picrotoxin was then in-

creased on the next following treatment day. If the patient had no recollection of the second injection a smaller amount of picrotoxin was given the next time.

COMPLICATIONS.

The infrequency of nausea and vomiting was mentioned. Mandibular luxation was a common occurrence. Two patients sustained a dislocation of one shoulder, one a fracture of the scapula, one a fracture of the jaw, and one a bilateral fracture of the humerus. Roentgenologic examinations of the vertebral column were not made routinely. However, anterior-posterior and lateral views of the entire spine were taken of every patient who complained of postparoxysmal pains suggesting root distribution. All plates were negative.

CONCLUSIONS.

1. A report is given of 102 patients treated with picrotoxin as convulsant. 64 of the patients received a combination of picrotoxin with metrazol.
2. The combined treatment reduces nausea and vomiting to a minimum. Multiple convulsions occurred in two instances only. Terror was absent, and the paroxysm was induced in a conveniently short time.
3. Complications were approximately the same in type and frequency as when picrotoxin or metrazol alone were used.

INVOLUTIONAL MELANCHOLIA.

ADDITIONAL REPORT.

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It has been estimated that involutional melancholia constitutes approximately 3 or 4 per cent of all mental disease, and is therefore responsible at any time for 15,000 to 20,000 cases of mental illness in this country alone. Almost all women have some of the nervous, circulatory and general symptoms which characteristically occur¹ as a result of the endocrine-autonomic nervous system imbalance, whenever ovarian function is disturbed, especially following castration, ovarian hypofunction during the menacme and at the climacteric.

In some women the time for endocrine adjustment to occur at the climacteric is of short duration, perhaps three to six months, and the symptoms such as subjective nervousness, hot flushes, depression, irritability, etc., are comparatively mild. In others the adjustment of the endocrine balance characteristic for the post-menopausal period is more prolonged and difficult and the duration may be from three to six years. Some of these women have the more severe symptoms such as intense subjective nervousness, decreased memory and ability for mental concentration, emotional instability, disturbing mental aberrations and profound depression with thoughts of self-destruction. It is this condition that has been diagnosed as involutional melancholia.

Since the original experimental investigation of the effect of theelin (estrone) in involutional melancholia was reported by

¹ Werner, August A., Symptoms Accompanying Ovarian Hypofunction, J. Missouri State Med. Assoc., 28:363, August, 1931; *ibid.*, Syndrome Accompanying Deficiency or Absence of the Ovarian Follicular Hormone; Endocrinology, 19: 695, Nov. and Dec., 1935.

Werner and associates² in 1934, additional favorable reports have been published by other capable investigators.

Little and Cameron³ reported that 11 cases of mental disturbance occurring in connection with menopause responded without exception to theelin therapy. They stated, "from the results of this investigation it may be seen that where anxiety symptoms seem to arise from the abnormal action of the endocrine glands governing sex activity, the use of theelin appears to be almost specific. In psychosis not associated with the menopause, the effects were doubtful."

Additional evidence is submitted by Mazer and Israel⁴ who treated a group of 33 patients presenting severe climacteric symptoms. Three had attempted suicide and three others were obsessed with a desire for self-destruction. Not one of the 33 patients, regardless of the severity of their symptoms, failed to respond to estrogenic therapy.

Tarumainz,⁵ in discussing "psychiatric implications of endocrine disturbances," stated that in many cases of involutional melancholia treated in the Delaware State Hospital, success followed the use of theelin.

Since the original experiments were reported in 1934, we⁶ published the results of theelin treatment of involutional melancholia in 14 additional cases in 1937. In this second group of 14 women, 11 were recovered and socially adjusted in a period of a few months and allowed to return home. Of the three remaining

² Werner, August A., M. D.; Johns, George A., M. D.; Huctor, Emmett F., M. D.; Ault, C. C., M. D.; Kohler, Louis H., M. D.; and Weis, Matthew W., M. D., *Involutional Melancholia, Probable Etiology and Treatment*; J. A. M. A., 103: 13-16, July 7, 1934; and Werner, August A., M. D.; Kohler, Louis H., M. D.; Ault, C. C., M. D.; and Huctor, Emmett F., M. D., *Involutional Melancholia, Probable Etiology, and Treatment*, *Archives of Neurology and Psychiatry*, 35: 1076, May, 1936.

³ Little, G. A., and Cameron, D. E., *Canadian Med. Assoc. Jour.*, 37: 144, 1937.

⁴ Mazer, C., and Israel, S. L., *Medical Clinics of North America*, 19: 205, 1935.

⁵ Tarumainz, M. A., *Psychiatric Implications of Endocrine Disturbances*, *Delaware State Med. Jour.*, 8: 93, 1936.

⁶ Ault, C. C., M. D.; Huctor, Emmett F., M. D.; and Werner, August A., M. D., *Theelin Therapy in the Psychoses*, J. A. M. A., 109, 1786, Nov. 27, 1937.

women, one had been treated only two weeks and showed slight improvement; two had been treated four weeks and showed moderate and slight improvement respectively.

We now wish to report a third group of 13 women who were treated for involuntional melancholia with theelin since July, 1937.

The average age of these women was 43.6 years, the average duration of recognized psychoses before admission to the hospital was 53.5 days and the average duration of treatment before parole was granted, based upon social adjustment, was three months.

NEW CASES OF INVOLUTIONAL MELANCHOLIA.

Name.	Age.	Days of psychosis before admission.	Months in hospital.	Date of parole.
I. R.	48	45	6	June, 1938
E. R.	49	16	2	Jan., 1938
V. P.	44	60	5	April, 1938
M. P.	49	40	5	May, 1938
I. G.	42	90	7	July, 1938
D. P.	42	30	2	March, 1938
M. S.	41	90	2	Oct., 1938
D. S.	49	60	1	Dec., 1938
A. B.	40	60	2	April, 1939
A. G.	47	90	3	May, 1939
I. P.	38	70	1	July, 1939
S. G.	46	31	1	Nov., 1939
M. D.	32	14	2	Aug., 1939

The last patient was a surgical menopause, but all the others were true involuntional melancholia. The involuntional psychosis in the castrate, confirms the endocrine basis for this condition.

DISCUSSION.

In the original experiments, theelin in aqueous solution (50 rat units per cc. daily) was used, for estrogens in oil were not available. This amounted to approximately 9000 to 12,000 international units per month. We now recognize that these dosages were small, were quickly absorbed and perhaps quickly eliminated.

In the second experiment we administered 30,000 to 40,000 international units of theelin in oil during the first month, and then reduced the dosage to conform to the needs of the individual patient.

In this (third) group of women, 30,000 to 60,000 international units of theelin in oil were injected during the first month and then as improvement occurred, the dosages were reduced to 2000 to 10,000 per week.

It might be well to mention that metrazol shock therapy is being used in treatment of these cases in some hospitals. Metrazol shock therapy is extremely severe and we believe that its use in involutional melancholia is hardly justified until the patient has had a fair trial with estrogenic therapy.

CONCLUSIONS.

1. The recovery rate of patients having uncomplicated involutional melancholia treated with theelin in our hospital is above 90 per cent.
2. Larger dosages than were originally used by us, are more efficacious and are recommended.
3. In view of these results, other severe forms of treatment, such as metrazol shock, do not seem justified in uncomplicated involutional melancholia, unless adequate estrogenic treatment fails to give relief.

"ABSTRACT" AND "CONCRETE" BEHAVIOR DURING HYPOGLYCEMIA.

REPORT ON A SINGLE CASE.*

By R. C. MOORE, BOSTON, MASS.

A recurring topic in the recent literature on psychopathology has been that of "abstraction" or "conceptual thinking." Goldstein has pointed out that in patients afflicted with cerebral lesion a basic change in personality consists in an impairment of the "abstract" or "categorical" attitude, with behavior in such cases restricted to a more limited, "concrete" type. Numerous experimenters have reported disturbances of conceptual thinking in schizophrenics, and more recently the application of Dr. Goldstein's techniques with schizophrenics has shown that an impairment of the "abstract" attitude very similar to that found in patients with frank cerebral lesion is not infrequently demonstrable. It is suggested that the degree to which the patient is still capable of the "abstract" approach is of prognostic significance. An article by Shipley appearing lately utilizes a measure of "abstraction" as part of a test for intellectual deterioration. Psychological phenomena occurring in disturbed physiological states with various drugs have been reported by numerous writers, but with little reference to the effect upon abstraction processes. Reports of changes during insulin treatment of schizophrenia likewise have little reference to this aspect of behavior.

In view of the foregoing, it seems pertinent to report the results of examinations touching on "abstraction" made on a single case, but a case where structural cerebral abnormality was not evident, and where comparison can be made between behavior in a "normal" state and in one of a physiological disturbance arising spontaneously.

The patient was admitted to the Boston Psychopathic Hospital because of transient episodes of amnesia and confusion. These episodes were found to be a function of hypoglycemic states with

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hyperinsulinism due to pancreatic tumor. This communication will concern itself only with the results of psychological studies; the psychiatric, medical and surgical aspects of the case are discussed in a contemporary report by Drs. G. P. Coon and J. Romano.

Examinations were made on two successive days. On the first day the patient was in good spirits, had just dined and showed no signs of hypoglycemia. The second examination followed a fast of approximately twenty hours, and though he was still highly cooperative motor evidences of hypoglycemia were apparent. Except for an intelligence test (short alpha, 81st percentile score) the patient was given the same battery of tests on both occasions, with those directly or indirectly touching the problems of abstraction including Street's gestalt perception test, the common psychiatric test of serial 7's, and a block design test. The block design test was that from the Bellevue intelligence test, with procedure according to Goldstein's modification for the Kohs blocks.

At the earlier examination results were straightforward, suggesting no abnormalities in any of the fields touched. Gestalt figures were recognized normally, 7's subtracted serially from 100 rapidly, accurately and in a smooth, continuous manner, and designs reproduced in a methodical, highly analytical manner. At the second examination, with the patient nearly in hypoglycemic shock, quite a different picture was seen. Fewer interpretations were given to the same gestalt figures, and the patient's dependence upon immediate sensory experience is to be noted from the response, typical for the uninterpreted figures, that they were "just black and white spots." When responses were forthcoming, they tended to be less elaborated and less rapidly given than formerly.

The subtraction of 7's serially from 100 was again performed correctly on this second occasion, but in strikingly different manner. The task took the patient six times as long, and in contrast to his previous smooth, continuous performance, it was evident that each operation was now entirely separate, it now being necessary for the patient to fixate the last answer given by several repetitions before he could undertake the next step. Since this task was by no means new to him, he was asked to subtract 7's serially from 99. This he could not do beyond the first step, and in arriving at the answer "92" he was observed to be counting "7" on his fingers—a very "concrete" performance!

The most striking differences were to be seen in the reproduction of designs by means of vari-colored blocks. In contrast to the earlier methodical, analytical approach, the patient was now able to construct only two of the designs without recourse to the simplified models. In both of these designs, gross elements correspond to individual surfaces of the blocks. None of the other designs could be reproduced before the stage of copying an actual block model, with failure on the intervening steps of full-size, full-size and lined models. The patient was again unable to construct the design from the original model immediately following success with the corresponding block model. Further indication of the patient's inability to "abstract" from the designs was seen in his tendency to align blocks directly over or beside the model before placing them in his production, his tracing with his finger in the air, both over the model and the reproduction, and his tendency to become "lost" unless he kept one finger on that area of the design where he was working.

That the inferior performance on the block designs during the hypoglycemic state was probably not due to perceptual or coordination difficulties is seen in the fact that accurate solutions occurred with ease when the actual block models were used.

These results suggest that during this patient's hypoglycemic state, the analytical and synthetical aspects of his approach were impaired, with a greater dependence on sensory impressions in his behavior. The performance described appears highly consistent with that characterized by Goldstein as the "concrete" attitude.

One may not, of course, draw generally applicable conclusions from examination of a single case, but it seems of considerable interest and bears implications for further research that the same sort of alteration of behavior can appear in cases showing damaged cerebral structure, in schizophrenics with no presumed modification of structure, and in a case showing profound physiological disturbance without evident cerebral morphological change.

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MASCULINITY AND FEMININITY IN PSYCHOTIC PATIENTS.*

AS MEASURED BY THE TERMAN-MILES INTEREST-ATTITUDE ANALYSIS TEST.

By BEULAH BOSSELMAN, M. D., AND BERNARD SKORODIN, M. D.

This paper reports a study of the interests and attitudes of 134 psychotic patients as to their masculinity or femininity according to the Terman-Miles Analysis.

The concepts of masculinity and femininity are subject to a wide variety of interpretations. Certain personality traits are generally accepted as characteristic of the male and others of the female; however, these concepts are vague and based upon superficial appearances which may in some cases mask more fundamental tendencies of the personality. Any attempts therefore to define more objectively the masculine versus the feminine temperament contribute to clear thinking on this subject.

Louis M. Terman and Catherine C. Miles¹ published in 1936 their "M. F. Test" which is the product of a research study covering eleven years directed toward the "quantification" of masculinity and femininity. They base their test on the differences in interests and attitudes expressed by thousands of male and female subjects ranging from adolescence to old age. The responses of any person on this test therefore are compared with those of others of his sex and status (age, education, occupation) and his score represents his deviation from the mean. The test is in questionnaire form and is made up of seven exercises: word association, ink-blot association, information, emotion and ethical attitudes, interests, opinions and introverted responses.

A few correlations determined by the studies of Terman and Miles may be of significance in evaluating our findings. They found no significant correlation between the score and body mea-

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¹Terman and Miles: *Sex and Personality*. McGraw-Hill Book Co.

surements. There was a positive correlation between extroversion and masculinity in college men and a slight tendency in that direction in college women. Intelligence was found to correlate positively with masculinity in women; there was no such relationship shown in men. Overt male passive homosexuals had highly feminine scores; a small series of overt female active homosexuals had masculine scores.

Since in such a test the results could easily be altered voluntarily, the purpose of the study is disguised under the title "Interest-Attitudes Analysis Test."

It might be expected that any group of people who deviate markedly from the norm in social behavior would show a deviation from the established standards of masculinity and femininity. This would be expected particularly of the schizophrenic group who in general are socially (including sexually) maladjusted. Terman and Miles suggest the desirability of the application of this study to mentally disordered persons. We have not been able to find any reports in the literature to indicate that this has been previously done.

The 134 subjects used in this study were non-deteriorated schizophrenic and manic-depressive patients from the University of Illinois Psychiatric Institute and the Manteno State Hospital. All had been classified after staff presentation. No patients were used who did not seem capable of understanding the test directions and of co-operating. All uncompleted or facetiously executed tests were discarded. The scores obtained were compared with Terman's expected score for age and education in table 29 of his book. A record was also made of the exercises in which each patient showed greatest and least deviation from the tendency of his sex.

Of the 48 male schizophrenic patients 32, or 66.6 per cent, deviated to the feminine side as compared with their expected scores; 16, or 33.3 per cent, deviated to the masculine side. Of the 59 female schizophrenic patients 42, or 71.2 per cent, deviated to the masculine side; 17, or 28.8 per cent, to the feminine side. Only female manic-depressive patients' scores were tabulated. Of these 27 patients 15, or 55.5 per cent, deviated to the masculine side; 12, or 44.4 per cent, to the feminine side. The mean deviation for schizophrenic males was 25 points to the feminine side; for

females 24 points to the masculine side; for manic-depressive females it was 6 points to the masculine side.

An observation of the individual test scores indicated deviations as follows:

SCHIZOPHRENICS.

GREATEST DEVIATION TOWARD OPPOSITE SEX.

Males.	Females.
Exercise 5.....(10 occurrences)	Exercise 4.....(24 occurrences)
Exercise 1.....(9 occurrences)	Exercise 2}.....(6 occurrences)
Exercise 4.....(7 occurrences)	Exercise 6}.....(4 occurrences)
Exercise 6}.....(5 occurrences)	Exercise 7}.....(3 occurrences)
Exercise 7}.....(2 occurrences)	Exercise 3}.....(1 occurrence)
Exercise 3}.....(2 occurrences)	Exercise 5.....(3 occurrences)
Exercise 2}.....(2 occurrences)	Exercise 1.....(1 occurrence)

LEAST DEVIATION TOWARD OPPOSITE SEX.

Males.	Females.
Exercise 4.....(24 occurrences)	Exercise 5.....(19 occurrences)
Exercise 3.....(5 occurrences)	Exercise 3.....(13 occurrences)
Exercise 6}.....(2 occurrences)	Exercise 4.....(12 occurrences)
Exercise 7}.....(1 occurrence)	Exercise 1.....(6 occurrences)
Exercise 5}.....(1 occurrence)	Exercise 7.....(2 occurrences)
Exercise 1}.....(1 occurrence)	

MANIC-DEPRESSIVE FEMALES.

GREATEST DEVIATION TOWARD OPPOSITE SEX.

Exercise 4.....(16 occurrences)
Exercise 2.....(4 occurrences)
Exercise 6}.....(2 occurrences)
Exercise 7}.....(1 occurrence)
Exercise 5.....(1 occurrence)

LEAST DEVIATION TOWARD OPPOSITE SEX.

Exercise 5.....(10 occurrences)
Exercise 3.....(9 occurrences)
Exercise 6}.....(2 occurrences)
Exercise 4}.....(1 occurrence)
Exercise 1.....(1 occurrence)

Where a patient's deviations in two or more exercises were alike the results were not tabulated. Although the series of greatest and least deviations in individual exercises is too small to be conclusive, it is interesting to observe that the schizophrenic male and female deviations are almost exactly reversed, the males deviating most on exercise 5 (interests) and least on exercise 4 (emotion and ethical attitudes); whereas the females deviate most on exercise 4 and least on exercise 5. The manic-depressive

females show deviations of a type practically parallel to those of the schizophrenic females. If further studies indicate the persistence of these trends, the findings suggest an interesting problem for analysis.

In general, the results of this study indicate that schizophrenic patients in a significant percentage (66.6 per cent and 71.2 per cent) deviate in their interests and attitudes toward those of the opposite sex. The mean deviation for the male patients is 25 points, for the female patients 24 points. Female manic-depressive patients, in contrast, deviate only slightly toward the opposite sex (55.5 per cent with a mean of 6 points).

Further studies of this kind are indicated and might lend themselves interestingly to some more specific analyses of the responses as representative of schizophrenic and manic-depressive reaction-types.

THE TREATMENT OF MORBID SEX CRAVING WITH THE AID OF TESTOSTERONE PROPIONATE.*

By H. S. RUBINSTEIN,† H. D. SHAPIRO,‡ AND
WALTER FREEMAN.‡

It is now known that small doses (5 mg. three times weekly) of testosterone propionate may temporarily stimulate libido in the normal male and that large doses (25 mg. three times weekly) may depress this function.¹ Because of these clinical experiences and because of laboratory observations to be described below, it became interesting to study the effect of this hormone on morbidly over-sexed females. While the term "morbidly over-sexed" can be taken to include the "perversions," this study is limited to a group of five patients whose strivings were normally directed but over-intense. In one of these patients the strong sex-desire in the presence of impaired inhibitive faculties resulted in overt anti-social behavior. In the other women the sexual craving was intense enough to result in anxiety, depression, restlessness or other more implicit disturbances arising from the frustrations which these unfortunates obviously experienced.

CASE I.—L. H., a white female, 44 years of age, was seen at the George Washington Hospital, December 7, 1938, at which time she complained of insatiable sex craving associated with marked tension and anxiety. Her menses began at 11 years, recurred every 28 days, lasted four to five days and were free from pain. At seven years of age she began to masturbate at approximately monthly intervals. This practice was continued until she was 22 years of age at which time she married a man two years her senior. After one year of marriage, during which time her sex life was satisfactory at a pace of two or three times weekly, her husband died. For the next three years her sex tension was satisfactorily relieved by monthly masturbation.

In 1921, she contracted "sleeping sickness" remaining continuously asleep for 13 weeks. Before this illness she weighed 115 pounds. From the time of her recovery she began accumulating fat and at the end of six months

* Read before the Neuro-Psychiatric Section of the District of Columbia Medical Society, February 1, 1940.

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weighed 194 pounds (Fig. 1). Neurologically she displayed bilateral tremors of the fingers, oculogyric crises and a mild Marcus-Gunn phenomenon.

From this time her libido increased markedly. In spite of her "feeling that it was wrong" she resorted to "illicit relations." Each indulgence was followed by remorse but her craving was so intense that she just "had to indulge." Satisfaction, however, was rare since she reached a climax slowly. Masturbation became very frequent.

In 1930, at the age of 35 years, she remarried, her second husband being six years her junior. Coitus occurred daily during the next four years when she and her husband parted. Since 1934 the situation had become more and more unbearable.

During the past two years her sex cravings have recurred in cycles of approximately six months each, a six-month period of marked excitement being followed by a four- to six-month period of relative calm. During the phase of excitement she would be constantly aroused, resort to frequent masturbation which, in spite of its climax, failed to relieve her. Sexual indulgence likewise gave her but brief ($\frac{1}{2}$ hour) satisfaction. At the time treatment was instituted a phase of excitement had already existed for about two months. When seen at the hospital it was almost impossible for her to sit quietly.

Treatment.—The patient had been taking hyoscine hydrobromide gr. 1/100 three times daily for a year before the present treatment was instituted. This relieved her tremors and oculogyric crises. Sedatives in the form of bromides and cold sitz baths for her sex craving had failed to help.

On December 10, 1938, she was given subcutaneous injections of 25 mg. of testosterone propionate in 1 cc. sesame oil (Perandren), and upon her return two days later she reported that she had experienced marked relief of sex craving. Twenty-five mg. were again injected on December 12 and 14. On December 17, 1938, she was so completely relieved that treatment was discontinued. At this time not only had the sex craving disappeared but her anxiety and tenseness had become so abated that she could actually relax when sitting or lying down.

She remained relieved for about four months, after which time she returned complaining that her old excitement was returning. She was given subcutaneous injections of the same hormone three times weekly for the next two weeks and again became completely relieved. During October, 1939, the tension again became quite unbearable. A short course of treatment was again instituted. She experienced no relief after the first injection but was so completely relieved after the second that she called on the telephone to state that she thought she could get along without a third injection. Since then the patient has remained quite complacent and further treatment has been unnecessary.

CASE 2 (reported through the courtesy of Dr. Antoine Schneider).—The patient, a white female 28 years of age, complained of marked and almost constant sensations of sexual excitement amounting frequently to feelings of orgasm and extending over a period of three or four years. There was a

history of active tuberculosis eight years ago with complete arrest for the past five years.

Although unmarried, the patient has a child now 18 months of age. During the past year, in spite of marked sexual tension, the patient has avoided sex relations.

Physical and neurologic examinations were negative and psychiatric survey disclosed no psychogenic factors as the cause of her condition. Since its onset, however, she had been afraid to go out in "mixed company" and has become restless and quite anxious about herself.

Psychotherapy was attempted but because of the constant distraction resulting from the spontaneous erotic sensations, it was without benefit. Treatment by local vaginal anesthetics also failed. She was then given four daily subcutaneous injections of testosterone propionate, 25 mg. each. Following these injections, the patient became calm, seemed at ease and lost her restlessness. Shortly thereafter, she resumed a normal life. Three months later, however, the symptoms returned but she remained refractory to further hormonal therapy. At the present time the patient is quite occupied and appears to be fairly placid.

CASE 3.—P. L., a white female, 42 years of age when first seen in January, 1939, complained of "periods of excitability, melancholy and anal itching." Menses began at 11 years of age and for five years recurred every 28 to 30 days, lasted three to four days and were normal in amount. At 16 years of age menses became quite copious during the three-day period. About the same time the patient noticed a tendency to "put on weight" and experienced a marked sex tension prior to flow. At 20 years of age she married and for a period of seven months coitus occurred two to three times daily. Thereafter, a pace of two to three times weekly seemed to suffice except during the week prior to her menses when she became insatiable.

About nine years ago she rapidly began accumulating fat and her weight rose from 145 pounds to 217 pounds. In addition, an increase in thirst and urinary frequency set in. During this period she has also felt the effects of frustration since her husband who was "frequently tired" became unavailable. This has resulted in restlessness, frequent headaches associated with insomnia and "melancholy" periods. These symptoms became particularly distressing during the week of her menses, although the sex arousal was quite marked from days 1 to 6, 14 to 16 and 20 to 22 of her cycle (day number 1 is the first day of the cycle).

Physical examination disclosed a female of medium height (62.5 inches) with marked obesity. The fat was distributed over the neck, shoulders, breasts, upper arms, upper thighs, pelvic girdle, trochanters and in the form of a panniculus adiposus. The heart was of normal size and the sounds at the apex were intact and normal. P_2 , however, was accentuated and equalled A_2 which was loud and thudding. Blood pressure was 184/120. Neurological examination was normal except for the absence of superficial reflexes.

Laboratory studies disclosed urine which contained albumen and occasional hyaline and granular casts. Blood urea nitrogen was 26 mg. per cent and

blood urea was 55 mg. per cent. The blood cholesterol was 420 mg. per cent. The electrocardiogram showed T_1 and T_2 to have a take-off below the isoelectric line, QRS III was directed downward, QRS I was directed upward. The T-wave in lead 4 F had a take-off above the isoelectric line. The basal metabolic rate was — 10 per cent.

Diagnosis was: (1) neurohypophyseal dysfunction with obesity, urinary frequency and polydipsia; (2) morbid sexual tension; (3) anxiety reaction on the basis of sexual frustration; (4) hypertensive cardio-vascular disease with myocardial involvement (left ventricular preponderance), and renal degenerative changes (granular casts).

Treatment.—The patient was placed on a low calory, high vitamin diet (carbohydrates 54 gm.; protein 70 gm., fat 9 gm.) and was given pituitrin (0) 1 cc. subcutaneously daily. Tr. of digitalis m. xv t. i. d. was also prescribed for her myocardial symptoms. She began to menstruate January 22, 1939. On January 24 and 25 she was given 25 mg. of testosterone propionate subcutaneously (total 50 mg.). On January 25 she reported that the feeling of passion was gone. The anal itching had disappeared and she could sleep well. She then stated that ordinarily her sex tension was so marked during the week of menstruation that she would feel as if she "were going mad" and "would pray for relief." She was given a third injection of 25 mg. January 26 and when seen the next day she stated that the sex tension had completely disappeared and that she was less troubled by thirst. In addition, it was noted that the excessive menstrual flow had also become definitely abated. Treatment was continued, testosterone propionate (25 mg.) being given on the first and second days of each menstrual period which occurred February 20, March 21 and April 20 with similar gratifying results.

CASE 4.—C. N., a white female, 32 years of age, was first seen in April, 1939. She had been married for two years and complained of marked sexual excitement at the approach of each menstrual period. The menses recurred at regular monthly intervals and, aside from the marked sex tension, were normal. Her husband, who at other times is quite capable, is unable to meet the added demands. The couple get along well in every other sphere of their marriage relations. One week prior to the estimated menses, the patient receives subcutaneous injections of 50 mg. testosterone propionate (25 mg. one week before, 25 mg. three days later) and this has satisfactorily allayed the sexual tension to the gratification of both the patient and husband.

CASE 5.—The patient, a white woman, 25 years of age, came to Washington after being expelled from a southern university for immorality. Upon arrival she attempted suicide with sodium amytal and upon being roused from the intoxication by small doses of metrazol, she spoke of feeling deeply the disgrace of her dismissal from college, particularly because it occurred through the tattling of a man with whom she had never had any close relations.

She was the youngest child in the family and had been rather petted and spoiled. She had displayed moodiness and emotional instability during childhood but was brilliant in her school work. She stated that she constantly

desired sexual intercourse and felt its need in order to continue making good grades in her studies. Her one aim in life was to secure sexual satisfaction which she was unable to obtain through masturbation, since it made her too nervous and tense. She could not tolerate the company of women, probably because they were considered to be competitors. She collected men as others would collect stamps or autographs and she kept a list of some 85 individuals with whom she had contact, although she had never accepted more than expenses. On one occasion, during the football season, she journeyed to a distant city and cohabited with at least ten of the football squad on the night before the game. (The team lost the next day.)

Coitus, however, resulted in a loss of interest in her partner, another soon being desired. In spite of her intense craving, she was rather slow to reach the climax.

She reached puberty at 13 years, had her first sexual experience at 18, was married at 20 but divorced after $3\frac{1}{2}$ years because her husband was unable to satisfy her. In the meantime she contracted liaisons with many men. She denied ever having a venereal infection.

Physically, she was below average height, of stout build with rather marked hirsutism, which led to her shaving. In addition, she pulled hairs from her lips and chin.

In order to combat the depression the patient was given six injections of metrazol in the course of 10 days. She became quite confused and then hypomaniac, antagonistic, abusive, and she finally lapsed into a catatonic stupor of four days' duration but finally completely recovered. On January 31, 1939, she was given 25 mg. of testosterone propionate, and two days later admitted that the imperative sex desire was much less than it had been but complained bitterly that she was being de-sexed.

In view of the complicating mental condition, it was deemed advisable to drop the treatment with testosterone propionate. Upon discharge from the hospital she resumed her former psychopathic behavior, dressing fantastically and seeking men whenever she could escape the watchful eye of her brother.

Discussion.—From the experiences herein reported it appears that large doses of testosterone propionate depress libido in the female, as well as in the male as previously known.¹

In a series of experiments conducted in this laboratory, it was found that 0.1 mg. testosterone propionate injected for 10 days either subcutaneously (females) or intraperitoneally (males) beginning at 22 days of age led to a significant inhibition of ovarian and testicular growth (Tables 1 and 2).

The ovarian depressing effect of this hormone, particularly in large doses (1 mg. daily in the rat) is so striking that in immature rats it not only inhibits but tends to disrupt the follicle (Fig. 2). If the same dosage is continued, the ovary fails to ovulate and remains markedly diminutive in size (Fig. 3). In the rat such

TABLE 1.

COMPARING THE MEAN WEIGHTS OF THE OVARIES AND PITUITARY GLANDS OF 32-DAY-OLD FEMALE RATS TREATED WITH 0.1 MGM. TESTOSTERONE PROPIONATE SUBCUTANEOUSLY FOR 1 DAYS AND SACRIFICED 24 HOURS AFTER THE LAST INJECTION WITH THEIR CONTROLS.

Weight of ovary—mgm.		Difference.	S. R.
Control:			
13 animals	14.9 \pm 0.57	2.2 \pm 0.71	3.10
Treated:			
13 animals	12.7 \pm 0.43		
Weight of pituitary—mgm.			
Control:			
13 animals	2.56 \pm 0.09	0.06 \pm 0.21	0.29
Treated:			
13 animals	2.50 \pm 0.10		

S. R. stands for "significance ratio" which must equal three or more in order for the observed difference to be considered statistically significant.²

TABLE 2.

COMPARING THE MEAN WEIGHTS OF THE TESTES AND PITUITARY GLANDS 32-DAY-OLD MALE RATS TREATED WITH 0.1 MGM. TESTOSTERONE PROPIONATE INTRAPERITONEALLY FOR 10 DAYS AND SACRIFICED 24 HOURS AFTER THE LAST INJECTION WITH THEIR CONTROLS.

Weight of testis—mgm.		Difference.	S. R.
Control:			
15 animals	730.0 \pm 22.1	276.7 \pm 29.1	9.75
Treated:			
12 animals	453.3 \pm 18.8		
Weight of pituitary—mgm.			
Control:			
15 animals	2.28 \pm 0.10	0.14 \pm 0.16	0.87
Treated:			
12 animals	2.14 \pm 0.12		

S. R. stands for "significance ratio" which must equal three or more in order for the observed difference to be considered statistically significant.²

ovarian inhibition results in a state of continued anestrus. In the human subject,^{3, 4} it may check menstrual bleeding.

The diminution of sex desire as a result of this treatment cannot be entirely attributed to gonadal inhibition however, since it is well known that neither castration in the male nor menopausal states in the female necessarily leads to impotence or frigidity.⁵ The psychogenic factors inherent in all sex difficulties cannot be denied but it is hardly likely that the relief in these patients was due to psychic influences. This conclusion appears justifiable since for the most part, with the exception of Case 5, the mental symptoms seemed to result from rather than lead to the sexual craving. Furthermore, previous therapeutic manipulations, sedatives, sitz baths and attempts at psychotherapy were futile.

While Tables 1 and 2 fail to reveal any depression in pituitary size as a result of treatment, it has been shown that testosterone propionate does inhibit the gonadotropic function of this gland.⁶ As a matter of fact, it is now known that, unlike many other glands, the size of the pituitary fails to reveal its state of activity. For example, treatment of animals with large doses of estrogenic substances inhibits the gonadotropic function of the pituitary and, at the same time, significantly increases the size of the gland.^{7, 8} On the other hand, administration of excessive amounts of testosterone propionate depresses the pituitary function without increasing its size.⁹ Since, in contrast to the ovariectomized animal, the hypophysectomized animal becomes completely asexual, it is assumed that as a result of the treatment, the gonadotropic function of the pituitary gland was sufficiently depressed to beneficially influence the exaggerated sex drive of these patients.

It must be realized, however, that only large doses of the hormone can be expected to bring about such an effect, since smaller and perhaps more physiological quantities fail to depress the pituitary gland.

Conclusions.—Five women with exaggerated sex urge were treated with large doses (25 mg.) of testosterone propionate, administered by subcutaneous injection at varying intervals. All patients experienced rather prompt relief which, however, was temporary. In three patients repeated courses of injections were followed by repeated periods of success. One patient failed to respond after initial relief, although she did remain somewhat

less perturbed. A psychopathic nymphomaniac was relieved but complained of being desexed.

Experiments stressing the gonadal inhibiting effect of testosterone propionate are described and the effects of this hormone on the pituitary gland are cited. The mechanism of action is discussed and it is concluded that testosterone propionate, when given in excess depresses the anterior pituitary gonadotropic function sufficiently to lessen the sex urge of the individual.

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The authors appreciate the cooperation of the Ciba Pharmaceutical Products Company, Inc., for partially defraying the expenses of this study and for furnishing the testosterone propionate (Perandren) used in the treatment of the cases reported.

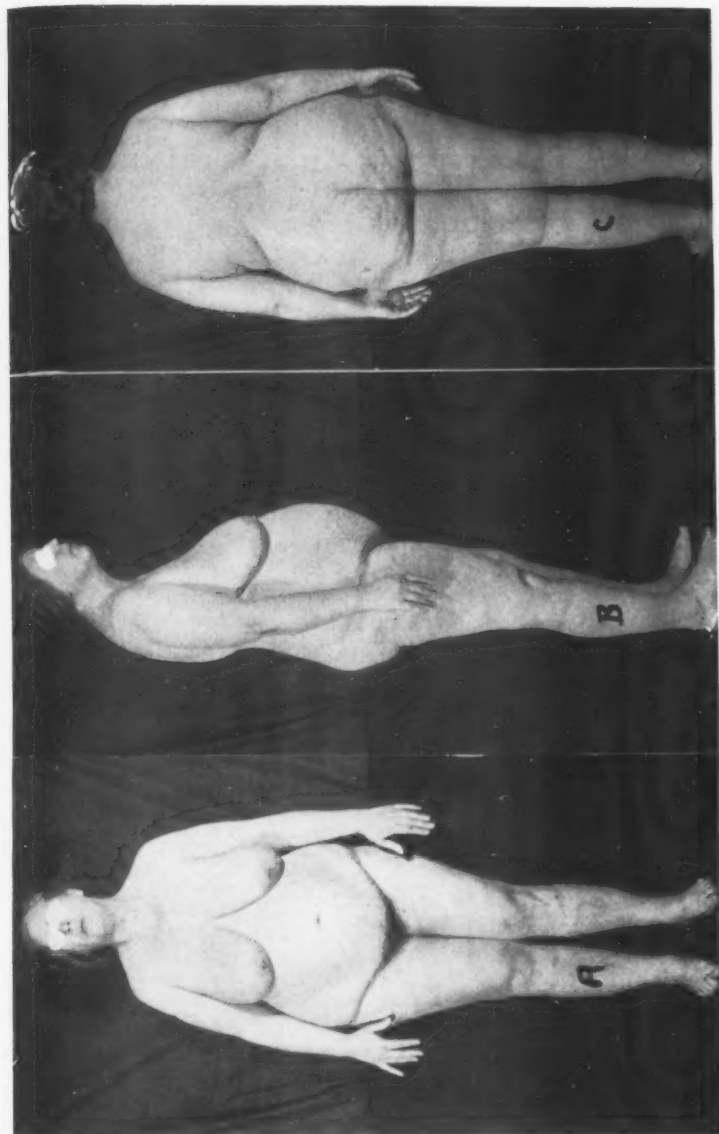


FIG. 1.—Pituitary Obesity Following Encephalitis Lethargica.

- A. Front view showing pendulous breasts, genu valgum.
- B. Side view showing shoulder girdle obesity, tapering arms, panniculus adiposus.
- C. Dorsal view showing pelvic girdle adiposity and trochanteric fat deposits.

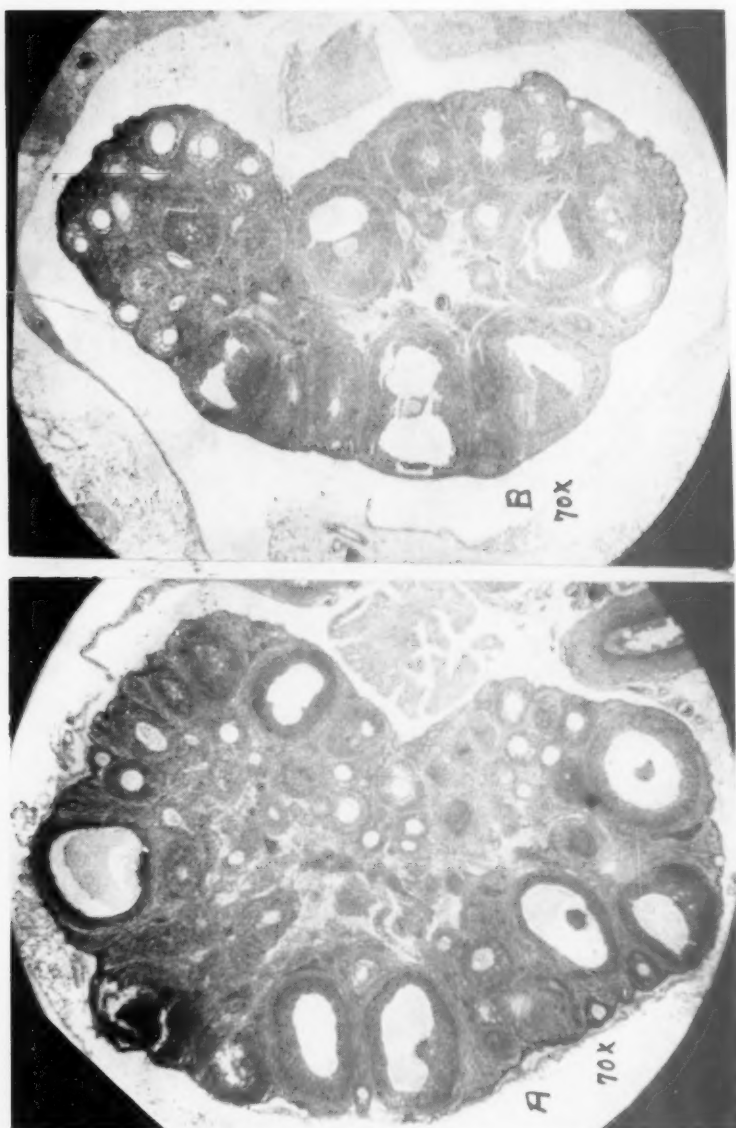


FIG. 2.—Ovaries of Immature (32 Days Old) Rats.

A. Control showing well organized and intact follicles.
 B. That of animal treated with 1 mg. testosterone propionate daily for 10 days prior to sacrifice. Follicles less highly developed and somewhat disrupted.

A. Control showing well organized and intact follicles.
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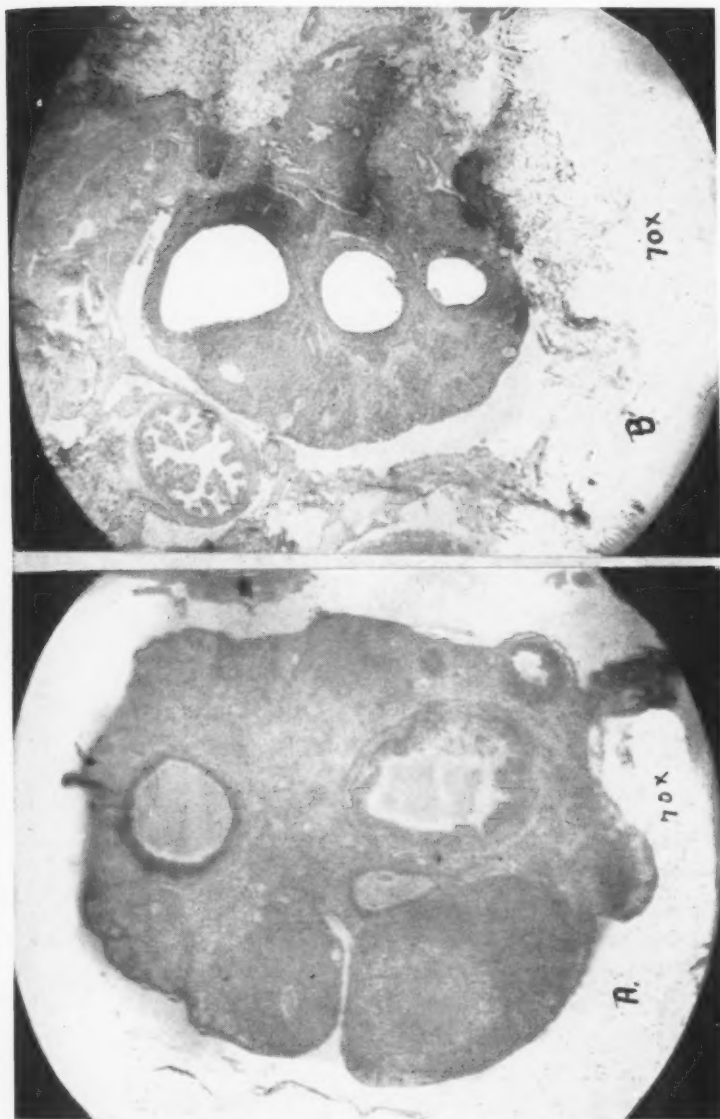


FIG. 3.—Ovaries of Animals Old Enough to Ovulate (45 days).

A. Control showing well organized corpora lutea.
 B. That of animal treated with 1 mg. testosterone propionate daily for 10 days showing diminution of gross form, persistence of unruptured follicles and atretic follicles.

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PSYCHIATRIC PROBLEMS IN A CLINIC FOR CONVULSIVE DISORDERS.*

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The purpose of this study was to determine the incidence and type of mental aberrations occurring in a clinic for the treatment of the convulsive state. In 1936 the department of nervous and mental diseases of Northwestern University Medical School, under the chairmanship of Dr. L. J. Pollock, started a special clinic for the purpose of classifying and directing the management of indigent patients suffering from epilepsy. Three hundred fifty patients have been studied and treated since then. Exclusive of the feeble-minded and deteriorated patients who were obviously institutional cases this report includes all the multifarious psychiatric aberrations found in our group. The following mental problems were encountered: Those associated with the actual treatment; alcohol intoxication; status epilepticus and psychic equivalents; organic brain disease; trauma to the head; environmental factors and associated mental disease. There were 26 patients among the 350 who showed psychiatric problems.

All contributions on the therapy of the convulsive state have been premised and justifiably so on the reduction or complete cessation of the attacks. Very little attention on the one hand has been paid to the mental problems that may arise in the course of the management of such cases other than the seizure. On the other hand, however, there has been considerable discussion of the so-called epileptic constitution. From the earliest text books of neurology to the present publications one is constantly made aware of the mental makeup of the individual suffering from an idiopathic epilepsy. It is said that in the classical epileptic one

* Read before the Illinois Psychiatric Society, February 1, 1940.

From the Department of Nervous and Mental Diseases, Northwestern University Medical School.

From the Minnie Frances Kleman Memorial Fund.

finds unreliability, irritability, suspicion, hypochondriasis and moroseness. There is also an unusual sensitiveness, insincerity and egocentricity. The individual is supposed to pay great attention to himself, his own feelings, his state of health and his physical comforts. Jelliffe¹ states that passing attacks of mental disturbance occur in the interparoxysmal period without apparent relation to seizures. According to Aschaffenburg² attacks of transitory ill humor occur in 78 percent of cases. This ill humor may be irritability, unreasonableness, delusions and hallucinations. He also states that the mental abnormalities may be due to the psychic equivalents and are frequently associated with drinking. Clark³ found the so-called epileptic constitution to be the result of the convulsive state and not due to a precedent condition. Kraepelin⁴ found transitory conditions of depression, excitement, confusion, delirium, stupor and periods of ecstasy with hallucinations as well as paranoid states. He also spoke of the propensity toward dipsomania of epileptic patients suffering from depression. Hughlings Jackson⁵ described the post-epileptic psychoses as stages of reevolution from the dissolution occurring in the seizures. Raecke⁶ classified post-paroxysmal states as stupor, delirium, paranoid and maniacal conditions. Lange⁷ suggested a serial classification beginning with epileptics never having clouded states, passing to those who have had them, thence to those with clouded states accompanied by isolated or outspoken schizophrenic symptoms, next to schizophrenics with isolated seizures, and ending with schizophrenics without convulsions. Notkin⁸ reported eight cases of epileptic manifestations occurring in three manic depressive and five schizophrenic patients. He claimed such an occurrence to be rare. He does not feel that these spells are due to the mental disease. It is well known that as epileptic equivalents there may occur phases of so-called epileptic automatism. Here the patient may do anything including the commission of crimes, and yet when he comes to will have absolutely no recollection of what has happened. Clark and Lesko⁹ in a paper on psychoses associated with epilepsy reported on 22 patients. Fourteen of these had clouded states, "which were found to be transitory obscurings of consciousness of varying depths developing some years after seizures first began, usually occurring after several successive convulsions, characterized nearly always by overactivity, by variable

speech abnormalities, wide variations of mood, visual and auditory hallucinations, delusions, disorientation, poor recent memory, defective judgment and little or no insight." Three of the 22 cases had chronic psychoses resembling schizophrenia; one case was considerably deteriorated; the remaining four were unclassified.

No attempt was made in our study to review all the contributions on the question of mental changes in the epileptic.

OUR MATERIAL.

There were 26 among 350 patients who showed mental aberrations in one form or another. Our case reports are necessarily brief because of the large number. Where there is a pertinent family history it will be stated, otherwise no mention will be made. The first case of confusional psychosis was due to an idiosyncrasy to bromides. Cases 2 to 6 were due to alcoholic intoxication. Cases 7 and 9 were associated with status epilepticus. Cases 8, 10 and 11 were associated with psychic equivalents. Case 12 was that of general paresis. Cases 13 to 19 were due to organic brain disease. Case 20 was associated with schizophrenia. Cases 21 to 23 were due to reaction depression. Case 24 was associated with hysteroid manifestations and environmental factors. Case 25 was associated with a psychopathic personality. Case 26 was in all probability an epileptic psychosis.

CASE REPORTS.

CASE I.—F. S., a 38-year-old white male, a bank clerk, began having convulsive seizures at twenty years of age. There was no evidence of organic disease. Until his entrance into the clinic he not only continued to have attacks of convulsions but had over a long period considerable emotional difficulties. He had been divorced. His father had been imprisoned because of embezzlement and ever since his father returned home from prison there had been constant friction with the patient. Because the number of spells was only reduced while on phenobarbital therapy it was decided to change the medication to sodium bromide. Following this he developed a confusional psychotic episode although his blood bromide content was 140 mgms. in 100 cc. of blood. He recovered after a period of hospitalization and returned to work. Suddenly he quit his job and withdrew all his accrued benefits from the firm where he had worked, although they would have given him a leave of absence. He talked of suicide. Despite removal of the medication there was no change. He became abusive at home, was very argumentative with everyone and threatened to

do bodily harm to his father. He agreed to voluntary commitment in a state hospital but remained there only ten days. Following the death of his mother his mental condition improved somewhat. He is now on phenobarbital medication and his mental status is considerably better. Encephalogram showed some convolitional atrophy. He continues, however, to have many petit mal and an occasional grand mal seizure.

Diagnosis.—Idiopathic convulsive state with confusional psychosis due to an idiosyncrasy to bromides. Mental depression.

CASE 2.—C. L., white male 38 years of age, janitor, has been attending the clinic since July, 1935. His seizures started at 23 years of age. There was no objective evidence of organic disease of the central nervous system. His I. Q. was 100. On bromide medication he was entirely free of all attacks for four years. In the past year his sister reported that he was quarrelsome, was disturbing the neighbors, and would clean the porch of his flat at all hours. He also was abusive. He lied to us and to his sister. Following a frank discussion he admitted that he was drinking and had decreased his medication. The blood bromide determination showed a decrease in the bromide content. He had no seizures during these debauches. Since the talk he has remained sober and has had no abnormal behavior.

Diagnosis.—Idiopathic convulsive state and alcoholic intoxication.

CASE 3.—J. W., a white male 21 years of age, started to have major, minor, equivalents and status attacks since 20 years of age. There was no objective evidence of organic disease. His I. Q. was 97. His father died of general paresis and chronic alcoholism. For two months after the starting of treatment all attacks stopped. For no apparent reason the seizures recurred and it was then found from the patient's mother that he was drinking. With this recurrence of seizures he became abusive and threatened her life. A discussion with the patient was of no avail. He continued to drink periodically and at such times used profanity, became disturbed and had multiple attacks. He made sexual advances to his 10-year-old sister. He could not be trusted with the home finances. After a drinking spree he was incarcerated at Bridewell. While drinking he would stop taking his medicine. He was cared for at the clinic for 14 months and during that time had three attacks of mental aberration requiring psychiatric commitment. He has not been seen in the clinic since August, 1938.

Diagnosis.—Idiopathic convulsive state and alcoholic intoxication.

CASE 4.—R. R., a 28-year-old white male, began to have seizures at the age of eighteen years. No objective evidence of organic disease was found. His I. Q. was 88. Despite all our efforts to convince him that proper treatment and following of orders would stop his convulsions he continued to have spells for two years. He would go on a "spree" periodically and develop status and mental confusion. On two occasions he was hospitalized and in one instance he was sent to the psychopathic hospital because of confusion, abusiveness and destructive tendencies. Finally, after several discussions and the promise of keeping him at work he began to follow

instructions and quit drinking. He has been absolutely well mentally and attack free for the past year. He has been working regularly for one year.

Diagnosis.—Idiopathic convulsive state, status epilepticus and alcoholic intoxication.

CASE 5.—P. D., a 32-year-old white male who had convulsions since 25 years of age, was seen in the clinic for the first time in June, 1936. His seizures consisted of major, minor and equivalent attacks. Bromide, phenobarbital and rabies vaccine therapy were of no avail. While on drinking bouts his seizures would increase and he would get into the usual difficulties at home and in the community, associated with alcoholism. He believes the relief agencies as well as the world are against him. He uses his budget for everything but home needs. He gets into one scrape after another. The state hospitals refuse to accept him because he is not psychotic. We are having difficulty in maintaining him on medication as well as trying to persuade him not to drink.

Diagnosis.—Convulsive state in a chronic alcoholic and psychopathic personality. (Periodic alcoholic intoxication.)

CASE 6.—B. P., a white male 41 years of age, has had seizures since he was 22 years old. At 21 he suffered a severe influenzal infection which lasted four months. There was no objective evidence of organic disease of the central nervous system. He never had any previous behavior problems and was a very cooperative patient. From 1936 until 1939 he was entirely attack free on phenobarbital therapy. In April, 1939 while on this treatment he was induced to take five or more drinks of whiskey. The next thing he remembered was that he was being beaten up by the police because he had stabbed a man with a knife during an argument. The legal charge was dropped and he has not had any further mental difficulties.

Diagnosis.—Idiopathic state with a mental aberration resembling a psychic equivalent following the drinking of alcohol.

CASE 7.—H. S., a 45-year-old white male, has had major and minor attacks for forty years. He showed no objective evidence of organic disease of the central nervous system. He has an I. Q. of 118 and has always made a living as a salesman. In July, 1938, he was admitted to the psychopathic division of the Cook County Hospital in a confused state. This followed multiple seizures in a very short period (several hours). He became delusional and confused. He imagined "dope peddlers" were following him and that he was "dodging cars." He felt that he had died and gone to heaven. He also felt that a woman he had embraced was his dead mother. In four days he became normal and in contact with the outside world and was discharged. Since being on sodium bromide medication he has had no spells and no recurrence of the mental confusion.

Diagnosis.—Idiopathic convulsive state with mental confusion following status epilepticus.

CASE 8.—H. O., a 37-year-old white male, has had attacks of convulsions since he was 17 years of age (past 20 years). He would have occasional

major seizures and frequent psychic equivalents. During the latter he attacked policemen, beat his wife and would constantly antagonise her. He showed no objective evidence of organic disease of the central nervous system. His I. Q. was 118. He has not been able to work on account of his attacks and his wife has been reminding him of his failure to work. He may have to be committed since he refuses voluntary commitment. He is a constant menace to his wife and daughter. This has caused him to be consciously offensive to her. Despite large doses of bromides and phenobarbital his attacks (major spells and equivalents) have not been reduced materially.

Diagnosis.—Idiopathic convulsive state with mental aberration during and following psychic equivalents.

CASE 9.—E. J., a 36-year-old white male, has had attacks of convulsions for the past eleven years since he was 25 years of age. He has shown no objective evidence of organic disease of the central nervous system. He was of average intelligence. He has always been recalcitrant to large doses of bromides, phenobarbital or both. In the three-year period in which he was observed by us it was necessary to send him to the psychopathic hospital and then to a state hospital because of three episodes of severe mental confusion following seizures. He became abusive and insolent. He did not know where he was. The last attack of confusion occurred after he was put on dilantin.

Diagnosis.—Idiopathic convulsive state with a psychosis following multiple major seizure.

CASE 10.—A. R., a 16-year-old boy, has had spells for the past three years. These were major, minor and status epilepticus. Following the attacks of status he would develop at times a mental confusion. Occasionally the mental confusion would follow an epileptic equivalent. He would wander about the streets at times with insufficient clothing. There was no objective evidence of organic disease of the central nervous system. An encephalogram was entirely normal. His I. Q. was 85. He did poorly on treatment; his attacks were not arrested or decreased in frequency. When the dosage of bromides or phenobarbital was increased he became toxic and confused. He was committed to the state hospital because of a mental confusion.

Diagnosis.—Idiopathic convulsive state with mental confusion associated with attacks of psychic equivalents.

CASE 11.—D. C., a 26-year-old white female, has had convulsive and unconscious attacks including psychic equivalents since she was 16 years of age. Her attacks have been major, minor and equivalents. Her I. Q. was 83. Despite therapy with bromides, phenobarbital, dilantin and rabies vaccines she has remained recalcitrant. Following the attacks she becomes maniacal, destructive, belligerent and threatening. Between attacks she is very demanding and wants things done her way. There were no objective signs or symptoms of organic brain disease.

Diagnosis.—Idiopathic convulsive state with mental aberration associated with major, minor, psychic equivalents and during the interparoxysmal period.

CASE 12.—B. J., a 40-year-old white female, began having spells at the age of 22 years. Her 2 children have convulsions. In March, 1935, she was hospitalized for study and no objective evidence of organic disease of the brain was found. Because of her visual auras she was classified as a focal convulsive state. While in the clinic she was very irritable, uncooperative and argumentative. Despite medication the convulsive attacks persisted although she stated she had no attacks. Finally she became difficult to manage in the clinic because she had delusions of reference. One year after her hospitalization her husband was found to have syphilis. Our patient was re-examined in the hospital and a second spinal puncture revealed a positive Wassermann reaction in the spinal fluid and organic evidence of central nervous system syphilis. She was committed to a state hospital as a case of general paresis.

Diagnosis.—Convulsive state and general paresis.

CASE 13.—E. V., a 13-year-old white boy, was referred to the clinic by the Chicago Institute for Juvenile Research because of his convulsive attacks. He had both major convulsions and psychic equivalents. His I. Q. was slightly above normal (100). In addition to the seizures he was a kleptomaniac and a liar. He would readily give his word but would never keep it. Neurological examination showed a left hemiparesis of long standing. He was placed on bromide medication and had a complete arrest of spells. Despite this arrest of seizures his stealing and lying persisted. He has not been to the clinic for over a year.

Diagnosis.—Convulsive state; organic brain disease; kleptomania and psychopathic personality.

CASE 14.—R. McN., a 13-year-old white boy, has had major seizures since he was 9 months old. His attacks occurred very frequently—as often as eight to ten times daily. Examination showed an I. Q. of 48 with no other findings. He was not completely controlled on bromide or phenobarbital therapy. Two years after admission to our clinic, while on phenobarbital, he became delusional and hallucinated. He was abusive to his mother as well as being irritable to everyone else. He felt everyone was against him and intentionally annoying him and that he was being followed. Because of his behavior it was impossible to keep him at home and it became necessary to commit him to a state hospital.

Diagnosis.—Convulsive state with deterioration, delusional and hallucinatory state and feeble-mindedness.

CASE 15.—S. G., a 30-year-old white male, who for the past 8 years had mandibular, lingual and palatal spasms following an attack of encephalitis lethargica, began to have convulsive seizures at 27 years of age. Previous to the onset of his spells of unconsciousness he had been in conflict with the legal authorities and was sent to jail because of repeated petty larceny. He

was put on bromide in addition to the hyoscine that he was taking for his post-encephalitic spasms and has done very well. On one occasion it became necessary to give him sodium chloride because of toxic symptoms due to the bromides. At certain times he will get into minor behavior difficulties such as arguments.

Diagnosis.—Convulsive state due to a post-encephalitic infection. Behavior problem with stealing resembling a psychopathic personality.

CASE 16.—H. T., a 20-year-old white male has had convulsive seizures since he was 8 years of age. At times he would go into status epilepticus. He was classified as a birth trauma with a low intelligence quotient. His I. Q. was 70. While under management in the early part of his clinic attendance there was a decrease in the frequency but never a complete arrest of the attacks. One and one half years after his entrance into the clinic he became noisy, dictatorial, abusive, fault-finding and threatening to his family. The latter were afraid of him. He felt the world was against him. Several months after the onset of the abnormal mental behavior these manifestations became acute and he was committed to the Elgin State Hospital where he remained for three months. One year ago he had another attack of psychotic behavior in which he believed robbers were after him. As a result of this he closeted himself in his home, barricaded the door and threatened his family. He was recommitted to the Elgin State Hospital.

Diagnosis.—Convulsive state due to a birth trauma. Psychotic episodes due to organic brain disease.

CASE 17.—M. D., an 18-year-old white girl, has had convulsive attacks since a childhood infection at 2 years of age. Examination showed a right hemiparesis and an intelligent quotient of 90. Previous to the institution of treatment at the clinic the patient would have one to two major attacks per week. On bromide medication (90 grains daily) she would have no spells for a period of three months or more. One year after her entrance to the clinic she became irritable, spiteful and threatened everyone. She walked the streets at all hours and it was thought that she was sexually delinquent. Despite the reduction of the bromide and finally its replacement with phenobarbital the mental aberrations continued and her convulsive attacks returned. She had many delusions and hallucinations. She said, "God must be good to me because I have no fatal accidents during my spells." She talks to God. 'They' told her to quit taking the medication. She was finally committed to the Elgin State Hospital.

Diagnosis.—Organic brain disease with convulsive state and psychotic episodes.

CASE 18.—I. R., a 31-year-old white female, had spells since she was six months of age. They consisted of generalized convulsions and later auras of paresthesias in either upper extremity and peculiar body sensations. She had a skin lesion diagnosed as adenoma sebaceum. Her mental age was below normal and her intelligence quotient was 62. The patient was unable to take care of her only child. There was considerable friction between the

patient, her parents and her child. The parents tried to win the love of the child away from her mother. The parents called the patient insane. Although there was a complete arrest of all seizures on bromide medication she at times became delusional and hallucinated. She felt the police were after her. The papers printed articles about her. The radio broadcasted special messages for her. Her relatives called her insane and tried to have her put in an institution. Most of her delusions came from the newspapers and radio. When the bromide medication was reduced and a better understanding existed between the patient and her family the mental symptoms were diminished. She then remarried, and with added responsibility had further difficulty. At present she is fairly free from mental aberrations.

Diagnosis.—Organic brain disease (tuberous sclerosis), convulsive state and psychotic episodes.

CASE 19.—A. J., a 24-year-old white male, began having focal seizures at the age of 14 years. The attacks were ushered in by a numbness in the left side of the face. In 1935 a tumor in the right cerebral hemisphere (oligodendroglioma) was removed. Following this operation he was placed on sodium bromide and had no attacks of any kind for 12 months. His I. Q. was 70. During the past year he became recalcitrant to both bromide and phenobarbital therapy. During this time he started to show signs of mental aberrations. He became slowed up in his responses to questions and was delusional and hypochondriacal. Despite the disability he was able to work as a butcher's assistant until a convulsive attack would result in his dismissal. He would, however, get another job and hold it until his next attack. He believes that masturbation is causing his spells because he believes that masturbation is sinful. He is irritable and easily upset. He has temper tantrums in the clinic occasionally because he believes we have not helped him. Commitment to a state hospital is being considered.

Diagnosis.—Convulsive state due to a brain tumor. Psychotic episodes.

CASE 20.—J. M., a 40-year-old white adult male, began having spells at 21 years of age. These were both major and minor in character. He was seen for the first time in 1936 and showed no objective evidence of organic disease of the central nervous system. He was of normal intelligence. He never cooperated and never took his medicine with any regularity. Very often he came into the clinic in a so-called confused state. Because of this it was thought that he was drinking liquor. He continued to have convulsions. He complained of his treatment at the clinic and wrote letters, full of ideas of reference, to the various authorities of the University. He stated that he was being experimented upon and that the social workers were in conspiracy with the doctors, and the various "isms" attempting to use him as a guinea pig. He thought the WPA and relief groups were plotting against him since they did not permit him to work as an uncontrolled epileptic. He attributed this inability to work to our social service department, maintaining that this department wrote to the WPA that he should be discharged. An attempt was made to treat him at the office of one of us

to determine whether his attitude would change. Despite this he continued to be uncooperative and would not take his medicine.

Diagnosis.—Idiopathic convulsive state and schizophrenia.

CASE 21.—H. M., 31-year-old white male, has had exactly 81 major and minor seizures since he was 23 years of age. He was recalcitrant to both sodium bromide and phenobarbital. He showed no objective evidence of organic disease of the central nervous system. His I. Q. was above normal. After two months of ineffective therapy he was found dead. He left a note stating there was nothing to live for and that he had taken 65 grains of phenobarbital to end it all.

Diagnosis.—Idiopathic convulsive state with reactive depression and suicide.

CASE 22.—C. K., a 28-year-old white male, began having both major and minor seizures at the age of 18 years. In 1936 he was placed on sodium bromide and then phenobarbital. Although there was a decrease in the number of attacks from one seizure daily to one a week he has never been completely free from them. In January, 1939, without showing any signs or symptoms of any mental abnormalities he jumped out of a window and was killed.

Diagnosis.—Idiopathic convulsive state and suicide.

CASE 23.—M. S., a 43-year-old white male, a competent machinist, had his first convulsion when he was 29 years of age. He entered our clinic in July 1938. There was no objective evidence of organic disease of the central nervous system. His I. Q. was 119. He was placed on phenobarbital and since then has had no major convulsions. He occasionally gets attacks in which there is a momentary flash (seconds) of poor attention or inability to follow what is being said to him. Despite his freedom from convulsive seizures and only the occasional minor attack he complained of inability to work, difficulty in concentration, poor memory and poor vision. The eyes were entirely normal. He would cry and become downhearted because of these symptoms. He was afraid that he would not be able to hold a job because of his defects. He is receiving psychotherapy in the form of encouragement and explanation. He works fairly regularly.

Diagnosis.—Idiopathic convulsive state and reactive depression.

CASE 24.—G. V., a young white male of 17 years, has been having convulsive seizures since the age of 10. There have been and are still considerable home difficulties. All his convulsions are supposed to have followed difficulties and arguments at home where he would have temper tantrums. Following his removal from his home he had no more seizures until one year ago when he had a major convulsion.

Diagnosis.—Idiopathic convulsive state with hysteroid manifestations.

CASE 25.—L. S., a 22-year-old adult female, had focal attacks since she was 17 years of age. The convulsive seizures were ushered in by motor and sensory auras involving the right face and right upper extremity. There

was no objective evidence of organic disease of the central nervous system. During the three years she attended the clinic there was not the slightest evidence of cooperation. She took the medicine at her own will and discretion. She complained that the treatment (although she did not take the medicine as directed) made her worse. All subjective symptoms she attributed to the medicine. She was belligerent and insulting. She was promiscuous sexually. She finally became pregnant and then was married to the alleged father. She has not returned to the clinic for the past year.

Diagnosis.—Focal convulsive state with psychopathic personality.

CASE 26.—E. H., a 46-year-old married white female, began having major and minor seizures at the age of 30. There was epilepsy in her family. She has four children. She was in the Chicago State Hospital in 1925 at 32 years of age because of her mental aberrations. She had been at the Cook County Psychopathic Hospital on three occasions. There were many exciting factors which according to the patient caused her seizures. These were organ music, riding elevators, rapid walking and hyperpnea. The attacks were ushered in by an aura of voices talking or "a feeling of tiredness of the whole world." There was no objective evidence of organic disease of the central nervous system except for an external strabismus of the left eye. Her I. Q. was 104. There were no signs of tetany. She was placed on 66 grains of sodium bromide daily and had no spells. After a period of six weeks she developed a toxic bromide state and was hospitalized. Even after nearly all of the bromide was removed from the blood stream she continued to be confused and became delusional. She developed periodically attacks of furor in which she becomes very noisy, abusive and irritable. Because of her delusional state she was committed to Manteno State Hospital. She has only an occasional major convulsion.

Diagnosis.—Convulsive state and psychosis. In the State Hospital she was diagnosed as an epileptic with deterioration but her I. Q. is above average (104).

COMMENT.

The above study includes all the psychiatric aberrations found in our group of 350 cases exclusive of the feeble-minded and deteriorated patients who were institutional problems. In one case there was an idiosyncrasy to bromides even in small doses which resulted in a confusional psychosis. The latter cleared when the patient was taken off the bromide medication. In five cases mental aberrations occurred only in the course of an alcoholic spree and then in the absence of any seizures. The mental symptoms present were similar to those found in non-epileptics who become intoxicated. Two cases of mental aberration followed the onset of multiple seizures or status epilepticus; three cases occurred during psychic or epileptic equivalents. There was one case of meningo-

vascular syphilis. Six cases of mental abnormalities were due to associated organic brain disease; these were encephalitides, birth trauma, brain tumor, tuberous sclerosis and trauma to the head. There was one case of mental aberration associated with a schizophrenic makeup. There were three cases of reactive depression two of whom committed suicide. One case presented a hysterical makeup and an environmental problem. There was one case with a psychopathic personality and finally one case of an unclassified psychosis occurring in a 46-year-old female who remains delusional despite the fact that she has only an occasional seizure.

At the outset it may be stated that the so-called peculiar quirk or the mental habitus of the epileptic was found in only one case in our entire group. Certainly this would indicate, to us, that this concept of a specific epileptic personality is already an over-emphasized observation. That the individual suffering from a convulsive state may have some form of psychiatric aberration is admitted without reservation but that the mental aberration is directly related to the convulsive state is not admitted without reservation. There may occur and there do occur psychiatric manifestations in patients suffering from epilepsy during the interparoxysmal period. These mental abnormalities depend upon their cause and must not be dismissed by saying they are part of the epilepsy. In our study of 26 cases there were only seven in which the mental abnormalities could be said to be related to the convulsive state. The other nineteen cases were foreign to or separate from the epilepsy. These aberrations may be of a variegated type from simple misunderstandings to severe psychotic episodes. It is essential that all cases having convulsive disorders who present mental aberrations be studied in detail in order to determine the cause. The severe psychotic individual is better managed in a suitable hospital or sanitarium. This is especially true for mental depressions. The less severe psychotic patient may be managed in the clinic as an ambulatory problem. Very often alcoholic debauches in the patient with a convulsive disorder occur chiefly because of difficulties at home and inaccurate ideas regarding the nature of the seizures. In our group there were five patients who went on alcohol sprees and who did not know that their convulsive difficulty could be arrested or considerably improved by proper medication and the deletion of alcohol. In

order to prevent multiple seizures or status following an alcoholic escapade it may become necessary temporarily to increase the medication. This increase should be dependent upon frequent determinations of the bromide content in the blood stream. Any patient showing a severe idiosyncrasy to either bromides or phenobarbital should be either completely removed from such drugs or be given small doses in increasing amounts. It was thought that dilantin might be of assistance in this type of case and this drug is being tried at the present time. All psychoneurotic behavior can be managed in the clinic. Explanation, encouragement, persuasion, rehabilitation or removal to foster homes are very excellent aids.

Seventeen patients of our group of 26 are ambulatory, receive treatment and carry on a modified normal life. It is extremely important to promote better understanding between the patient with a controlled epilepsy and employers.

SUMMARY.

Twenty-six cases of mental aberration occurring in a clinic for convulsive disorders are herewith presented. The causes of the psychiatric difficulties are as follows: idiosyncrasy to bromides; alcoholic intoxication; status epilepticus; psychic equivalents; encephalitis; trauma to the head; brain tumor; tuberous sclerosis; schizophrenia; mental depressions; emotional instability and an unclassified case of psychosis.

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Comment.

RESOLUTION ON THE DEATH OF THE PRESIDENT-ELECT.

At a meeting of the Executive Committee of The American Psychiatric Association, September 15, 1940, was passed a Resolution of sympathy and regret in the death of the President-Elect, Dr. H. Douglas Singer. A copy of this Resolution was sent to the family of Dr. Singer.

The Executive Committee of The American Psychiatric Association, on behalf of the Council of the Association and the Association as a whole, greatly shocked by the untimely death of our friend and colleague, President-Elect H. Douglas Singer, presents herewith a Resolution to express our grief at his passing—

"Resolved, That in the death of Dr. H. Douglas Singer, our beloved President-Elect, The American Psychiatric Association has lost one of its most valued Fellows, a distinguished physician, teacher and editor. A fine working associate, deeply interested in our Association, with a vast circle of friends who esteemed him highly, he will be greatly missed. The Association extends to his family its deepest sympathy."

This Resolution is to be placed by the Secretary in the minutes of the Association and a copy sent to his family.

BASIS OF INTERNATIONAL UNDERSTANDING.

The first issue of *The Eugenics Review*, founded by Francis Galton, appeared in April 1909. In this number occurs an interesting comment on the hand of friendship and collaboration extended by one country to another. The editor remarks,

It is satisfactory to be able to announce that friendly relations have been already established between ourselves and the managers of a periodical akin to our own published on the continent of Europe and now in its sixth year. We refer to the *Archiv für Rassen- und Gesellschafts-Biologie*, edited by Dr. Ploetz, of Munich, and others.

The Honorary Secretary of The Eugenics Education Society of London had addressed a letter to the editor of the *Archiv* inviting

correspondence and exchange of publications. In his reply Dr. Ploetz said,

We tender you our best thanks for your friendly invitation, and heartily welcome in your *Eugenics Review* an English "sister-organ" of our own periodical.

I express the united opinion of my colleagues and myself when I say that we, too, consider it very desirable that those who are engaged in eugenic research in different civilised countries should be in close touch and sympathy with one another. On that account we joyfully grasp the hand you hold out to us. Meanwhile I forward to you a volume of our *Archiv*.

Personally, I should be glad to hear further details of the work of your Society, in which I am extremely interested.

Yours faithfully,

(Signed) ALFRED PLOETZ.

Reprinting this letter the editor of *The Eugenics Review* comments,

We have set out this letter in full because it is a type of what we may expect when eugenics has become not only of national but of international concern. As soon as the nations of the earth shall compete with each other not in armies and navies but in the art of race-betterment, they will be less disposed to sacrifice the flower of their youth and manhood in disastrous, devastating war; also, when their numbers are so kept within due limits that extension of territory will no longer be a necessity, they will cease to hanker after each other's possessions in order to find an outlet for their surplus population. Eugenics will thus bring a new blessing to mankind, for it will prove to be a harbinger and handmaid of Peace.

These greetings exchanged a generation ago by the pioneer publications of a new science in England and Germany reflect the traditions of happier days when science knew no national boundaries. They also indicate that scientists, *qua* scientists, who are not under pressure from the state, are everywhere like-minded human beings devoted to a common pursuit.

But the greetings here commemorated, and even their echoes, have long since died away. They were uttered in the days before the Nazi brand of science and eugenics came into being.

News and Notes.

THE NEW BIOGRAPHICAL DIRECTORY.—The attention of members of the Association is again called to the fact that a directory of members, containing a considerable amount of biographical information, is now in process of compilation at the head office.

Members who have not already done so are urgently requested to complete the questionnaires which have been sent to them and to return them with as little delay as possible to the office of the Association, Room 708, 9 Rockefeller Plaza, New York City.

For abbreviations and symbols to be used in completing biographical data please refer to the list printed in the September 1940 issue of the JOURNAL, p. 493.

FREUD MEMORIAL FELLOWSHIPS.—The Boston Psychoanalytic Institute announces three additional Sigmund Freud Memorial Fellowships for Psychoanalytic Training, to begin September, 1941. These fellowships are open to graduates of a recognized medical school, who have had at least one year of general hospital training, and two years' work in psychiatry, and covers tuition fees only.

One additional fellowship for training in applied non-therapeutic psychoanalysis will be open to those who have a Ph. D. or equivalent degree in the field of anthropology, sociology, pedagogy, etc.

For further information, please write immediately to Dr. M. Ralph Kaufman, Chairman of the Educational Committee, Boston Psychoanalytic Institute, 82 Marlborough Street, Boston, Massachusetts. Applications close on February 1, 1941.

GOVERNMENT TO NEED TEMPORARY AND PART-TIME CIVILIAN MEDICAL OFFICERS.—The expansion of the army creates a need for about 600 civilian medical officers in various grades for temporary and part-time service. The duties of full-time officers will be to act as doctors of medicine in active practice in hospitals, in

dispensaries, and in the field. The duty of part-time officers will be to report for sick call at a fixed hour each day and to be subject to emergency call at all times.

The Civil Service Commission in making this announcement calls particular attention to the fact that part-time officers will be able to continue their regular practice. In order that this may be done, appointments to the part-time positions will be made of medical officers in the vicinity of the place of duty.

Information concerning these positions may be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office, or from the United States Civil Service Commission, Washington, D. C. Physicians are urged to apply at once. This work is of the greatest importance to the success of the National Defense program.

AN APPEAL FROM THE NATIONAL CENTRAL UNIVERSITY, CHUNGKING, CHINA.—A letter received from Professor H. H. Hsiao, Head of the Department of Psychology of the National Central University at Chungking, states that owing to governmental control of foreign exchange the National Central University, since its removal to Szechwan has been unable to obtain current literature in the field of psychology, and he calls attention to the increasing need for up-to-date information in the prosecution of research work.

Donations in the form of reprints, periodicals or test forms are urgently needed and will be much appreciated. They may be addressed to The National Central University, Szechwan, China.

MEDICAL OFFICERS IN U. S. CIVIL SERVICE.—The United States Civil Service Commission announces that there is an urgent need for medical officers and senior and associate medical officers to fill permanent positions in various branches of the service. Positions in fourteen specialized branches of medicine are included and pay from \$3,200 to \$4,600 a year. Positions are also available for junior medical officers at Saint Elizabeths Hospital, Washington, D. C., at \$2,000 a year.

Information and application forms for examinations for these various positions may be had by writing to the Secretary, Board of U. S. Civil Service Examiners, Washington, from first- or second-class post offices, or from the U. S. Civil Service Commission in Washington, D. C., or any of its district offices.

MENTAL HEALTH SENTINEL.—In October, 1940, appeared the first issue of *Mental Health Sentinel*, the official organ of the Massachusetts Society for Mental Hygiene, superseding the *Monthly Bulletin*, which has been published since 1922.

Dr. Henry B. Elkind, editor of the new publication says, "Its two major concerns are: first, to work for the improvement of the service rendered patients in our public institutions caring for the mentally ill and defective, and second, to help stimulate those community measures which aim at prevention and research in the field of mental disorders as well as those which deal with positive application of mental hygiene principles."

This first issue, an attractive and copiously illustrated brochure of 30 pages, contains items of information, instruction and news in the field of mental health for parents, teachers, nurses, social workers, physicians, ministers and others.

The *Sentinel* is published quarterly at \$1.00 per year. The editorial office is at 3 Joy Street, Boston.

PSYCHIATRIC PROBLEMS IN MILITARY CONSCRIPTION.—At a meeting of The Medical Society of Saint Elizabeths Hospital, Washington, D. C., October 22, 1940, the program consisted of a discussion of psychiatric problems related to military conscription. The speakers on this program were Capt. Dallas G. Sutton, U. S. N., Lt. Col. William C. Porter, U. S. A., Dr. Harry Stack Sullivan.

DR. WITZEL APPOINTED SUPERINTENDENT OF NEWARK STATE SCHOOL.—Dr. William J. Tiffany, Commissioner of New York State Department of Mental Hygiene, has appointed Dr. August E. Witzel, first assistant physician of Brooklyn State Hospital,

and acting medical inspector for the Department of Mental Hygiene, to the superintendency of Newark State School, effective August 1, 1940.

Dr. Witzel entered the state hospital service in 1916. His scholastic training and his long clinical and institutional experience, together with his personal qualifications, eminently fit him for his new position.

THE DEVEREUX FOUNDATION.—The Devereux Schools of Devon, Pennsylvania, have announced that henceforth they will operate under the charter of The Devereux Foundation, a non-profit organization incorporated under the laws of The Commonwealth of Pennsylvania.

Helena T. Devereux, the founder and director of the schools, has transferred by gift all of the assets of the Devereux Schools to the organization now known as The Devereux Foundation. Organized in 1912, this school now provides education and training for more than 200 exceptional boys and girls, and is recognized as a leader in the field of special education. The change in the corporate control of the Devereux Schools entails no change in purpose, method or personnel. It is anticipated however, that the scope of its activities will be increased to include psychological and psychiatric research in connection with the study and treatment of children, and the establishment and maintenance of scholarships.

ANNUAL MEETING, AMERICAN ASSOCIATION OF PSYCHIATRIC SOCIAL WORKERS.—In keeping with the particular interest in professional education reflected by the American Association of Psychiatric Social Workers within recent years, their annual conference program * incorporated discussion of professional education as well as practice in psychiatric social work. The program papers of the first open meeting presented by the Association at the National Conference of Social Work held in Grand Rapids, May

* *The News-Letter*, Vol. X, No. 1, Summer 1940, may be obtained from the American Association of Psychiatric Social Workers, New York City.

26 to June 1, 1940, dealt with psychiatric social work in the time-limited interview, the mental hospital and aspects of administration of a psychiatric social service department. The second day's program, concerned with professional education for psychiatric social work, included an evaluation of class teaching and a discussion of field work supervision which is carried by the professional school of social work. A third session was devoted to three informal round-table discussions, and again reflected the subject matter of the open program meetings. Interest engendered by the program drew a large attendance, also evidenced at the Association's annual dinner, at which Dr. Temple Burling discussed the subject, "New Uses of Psychiatric Understanding."

The American Association of Psychiatric Social Workers' Committee on Relations with Psychiatry and the Committee on Psychiatric Social Service of the American Psychiatric Association have continued their collaboration in the matter of professional education in psychiatric social work. Recognition by both Associations of the need for well established field placement facilities in social service departments of mental hospitals and clinics, accessible to schools of social work offering psychiatric training, has led to a combined survey of available or potential developments in mental hospitals and clinics. Coordination of all activities of the joint committee with those of the American Association of Psychiatric Social Workers' Committee on Professional Education, has facilitated the study of schools of social work with respect to current programs, requirements and objectives for professional education in psychiatric social work. Associated with these interests, the formulation of a statement of minimum requirements for the professional personnel of psychiatric social service departments in mental hospitals has been in progress also by the joint committee of both Associations.

The American Association of Psychiatric Social Workers has now established a business office at the headquarters of the National Committee for Mental Hygiene, 1790 Broadway, New York City.

The Association reports its continued interest in government developments and its desire to carry its share of responsibility in whatever national emergency may arise from the present war in Europe. Means for preparing its membership to meet calls for emergency service were also considered at the annual meeting.

The officers and executive committee for 1940-41 are: president, Leona M. Hambrecht; vice-president, Glee Hastings Dervend; secretary, Amelia Igel; treasurer, Mary B. Laughead; executive committee members: Clara Bassett, Elizabeth Hand, Christine Robb Thompson, Louise Silbert and Katherine Moore Wickman.

The National Conference of Social Work and the American Association of Psychiatric Social Workers will hold their next joint annual meeting in Atlantic City.

LEONA M. HAMBRECHT.

THE ROCKEFELLER FOUNDATION ANNUAL REPORT FOR 1939.—Grants made by the Foundation in the year 1939 amounted in round figures to \$9,500,000. Of this sum approximately \$2,000,000 were expended in each of the four fields of public health, the medical sciences, social sciences and natural sciences. One million dollars was appropriated for work in the humanities, and approximately half a million dollars was devoted to rural reconstruction in China.

The Foundation sponsored work in 47 countries including every continent and the islands of the seas. Approximately 25 per cent of the total appropriation went to foreign countries as against 75 per cent expended in the United States.

In his report as Director of the Medical Sciences, Dr. Alan Gregg, commenting upon the activities of the Foundation in the medical sciences during the past decade, remarks "The main interest of this division since 1931 has lain in the development of research and teaching in psychiatry and neurology and subjects contributory to their advancement. A secondary interest has been the improvement of the teaching of public health, preventive medicine and hygiene to medical students. Concurrently, but in a subordinate relation, aid has at times been given to other projects in medicine, sometimes because they were of exceptional promise, sometimes because they were of general but very great value to medical progress as a whole."

The preferential consideration accorded to our fields of work is a matter of deep gratification to all members of this Association. Appropriations devoted to teaching and research in psychiatry, neurology and allied fields during 1939 amounted to \$699,330.

This was more than a third of the total appropriations in the division of the medical sciences; and if the subjects of neurophysiology and endocrinology be included grants in these combined fields amounted to nearly half the total medical appropriations.

On the recommendation of Dr. Gregg, psychiatry and neurology were supported by grants to the Johns Hopkins University School of Medicine, Harvard Medical School and Massachusetts General Hospital, the Institute of the Pennsylvania Hospital, the University of Colorado School of Medicine, the University of Illinois College of Medicine, the College of Physicians and Surgeons of Columbia University, Tulane University School of Medicine, the University of Toronto Faculty of Medicine, Tavistock Clinic (London), the Boston State Hospital, the University of Lund (Sweden), the Dikemark Mental Hospital (Norway), and the University of Oxford. Research in neurophysiology, etc., was supported at Yale University School of Medicine and the University of Brussels.

This generous treatment of neurology and psychiatry by the Rockefeller Foundation is an indication not only of increasing recognition of the importance of these medical disciplines, but particularly of the crying need for work in this field.

PENNSYLVANIA PSYCHIATRIC SOCIETY.—The second annual meeting of the Pennsylvania Psychiatric Society was held at the Bellevue-Stratford Hotel in Philadelphia as a dinner meeting on the evening of Thursday, October 3, 1940.

Dr. William C. Sandy, president, presided. This meeting was attended by sixty-eight members and nineteen guests.

Scientific presentations were as follows: "Mental Hygiene," by Appleton H. Pierce, M. D., Coatesville. Discussion by Howard K. Petry, M. D., Harrisburg. "Treatment of the Neuroses by Class Technique," by Samuel B. Hadden, M. D., Philadelphia. Discussion by LeRoy M. A. Maeder, M. D., Philadelphia. "First Impressions of Electroshock Treatment in the Psychoses," by Lauren H. Smith, M. D., Joseph Hughes, M. D., and Donald W. Hastings, M. D., Department of Mental and Nervous Diseases of the Pennsylvania Hospital, Philadelphia. Discussion by John F. Stouffer, M. D., Philadelphia.

Officers were elected as follows: President: Henry I. Klopp, M. D., Superintendent, Allentown State Hospital, Allentown, Pa. President-Elect: Baldwin L. Keyes, M. D., 2025 Walnut Street, Philadelphia, Pa. Secretary-Treasurer: LeRoy M. A. Maeder, M. D., Chancellor Hall, 206 South 13th Street, Philadelphia, Pa. Councillors: Arthur P. Noyes, M. D., Norristown, William W. Richardson, M. D., Mercer, Thomas A. Rutherford, M. D., Scranton, for two years; James S. Hammers, M. D., Lancaster, Charles H. Henninger, M. D., Pittsburgh, William C. Sandy, M. D., Harrisburg, Joseph C. Yaskin, M. D., Philadelphia, for one year. Auditors: Herbert C. Woolley, M. D., Philadelphia, for three years; George J. Wright, M. D., Pittsburgh, for two years; Leslie R. Chamberlain, M. D., Danville, for one year.

MOTION PICTURE FILMS FOR THE ANNUAL MEETING.—At the meeting in Richmond, as at previous meetings, motion pictures will be shown in a separate room. All those having films which they believe will be of interest to any particular group are requested to communicate with Dr. J. D. Reichard, U. S. Public Health Service Hospital, Lexington, Kentucky. Please advise Dr. Reichard the length or the running time of your film. Only 16 mm. silent film can be handled. Unless notifications are received on or before April first, 1941, the showing of your film on a definite schedule cannot be guaranteed.

Book Reviews.

CRIME CONTROL. State Laws 1935-1938, inclusive. State Law Digest Report No. 3, Library of Congress. (Washington: Government Printing Office, 1940.)

Here presented in convenient synoptic form are to be found the essentials of the various laws relating to the control of crime passed by the Congress and the States during the period 1935 to 1938, inclusive. The chapter headings indicate the scope of the compilation: Combating Organized Crime; State Enforcement Agencies and Functions; Local Enforcement; Crime Prevention; Beginnings in Procedural Reform; Prisons and the Prisoner.

One is impressed with the tendency toward greater centralization and coordination in methods of detection, apprehension and prosecution of the offender. Federal jurisdiction is being extended, and interstate compacts are being encouraged. Even within the states the various law enforcing agencies are being unified and coördinated. That these steps represent progress and increased efficiency cannot be doubted. Another encouraging sign is the development of the Uniform Law movement, whereby model laws are drawn up and proposed to the various states for action. Many such model laws have been rather widely adopted.

Of especial interest to the psychiatrist are the enactments providing for psychiatric aid to the courts and correctional institutions. Hawaii, for instance (p. 35), has provided that juvenile offenders shall receive a mental examination on commitment to the reformatories. A number of states (pp. 42-43) are enumerated as changing the procedure in criminal cases where "insanity" is an issue, among them, Arkansas, California, Colorado, Illinois, Kentucky, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Utah. Some of these statutes have previously been discussed in reports of the Committee on the Legal Aspects of Psychiatry. The tendency of the laws mentioned seems to be in the right direction, namely, providing for neutral experts and placing the decision in the hands of the court rather than of the jury.

Michigan and Minnesota are recorded as establishing classification clinics for persons convicted and sentenced, as a means of securing greater individualization of penal treatment.

Pennsylvania enacts the establishment of an institution for defective delinquents (p. 50), and Illinois and Michigan pass "sexual psychopath" laws (see Committee report for 1940). The parole of defective delinquents in Massachusetts is made contingent upon certification of the medical director, as it should be.

The volume is a valuable compilation for lawyers, social workers, and all interested in the problems of crime and of dealing with it.

WINFRED OVERHOLSER, M. D.,
Saint Elizabeths Hospital, Washington, D. C.

COGNITIVE PSYCHOLOGY. By *Thomas Verner Moore*. (New York: J. B. Lippincott Co., 1939.)

This scholarly book is an attempt to present a systematic interpretation of facts and hypotheses relating to the problem of cognition, rather than a discussion of the problems of perception as that word is employed in modern experimental psychology. The author is less interested in how the human mind receives information from the outside world than in the nature of mind itself. Basically, this book is a philosophical treatise which presents a metaphysics woven around psychological evidence from the laboratory and clinic.

The philosophical viewpoint defended in this book is based upon the doctrines of Aristotle and Saint Thomas Aquinas and all of the author's own theoretical contributions are in accord with the teachings of the Catholic Church.

The work is divided into seven parts. Part I deals with the relationship between consciousness and the nervous system. In this section the author cites a number of clinical cases exhibiting several varieties of impairments of consciousness. Such types of abnormality as amnesia, fugue, multiple personality and epilepsy are described and illustrated, and there is the suggestion that these maladies are all closely related. The first section closes with a review of the studies of cerebral pathology from which the author concludes, "There is no place in the nervous system where we can hope to find a point center of mental life to which all perceptions must be referred and from which all control of conduct must proceed" (p. 73). Because of the absence of localization and in view of the fact that he feels that no mechanical system can be conceived which can readjust itself as does the human mind after cerebral insult, he finds it necessary to postulate a vital principle identical with the *entelecheia* of Aristotle. This vital principle is not separate from the material body but is ". . . as intimate to the organism as the shape of a mass to the matter that is shaped" (p. 88). It is this *entelecheia* which determines the pattern of physical and mental development of the organism; it makes possible vicarious functioning when parts of the cerebrum are injured; it is active in memory and in intellectual experience. "Concepts, the knowledge of laws, principles, ideals, the higher aspirations of the will, are pure acts of the *entelecheia*, unlocalized and incapable of any localization in the nervous system. Living substance dies and disintegrates, but its elements are indestructible and eternal. And of these the *entelecheia* is one. Its life is not only organic and sensory, but above all intellectual, and this intellectual life remains" (p. 89).

Part II deals with the history of theories of perception. Beginning with Alcmaeon and concluding with the modern Gestalt psychologists, Moore

seems to feel that the value of any hypothesis varies almost directly with its similarity to the views of the scholastic philosophers. He attacks Wundt for his idealism and Titchener for his atomism. Configurational psychology finds more favor in his eyes but he deplores the Gestalters' refusal to admit that there is more to perception than the appreciation of configurations. The author feels that it is one thing to perceive a totality and another thing to understand and interpret it.

In Part III, after briefly outlining the physiology of sensation, the writer presents and illustrates his concept of "the synthetic sense." In regard to this sense he states, "One may thus arrive at the concept of a mental ability that has to do with the holding together in one complex unit the various elements of a sensory presentation; and, for the purposes of interpretation and adequate behavior, accentuating now this and now that element of the complex without losing the structural unity of the whole. We may term this ability the synthetic sense" (p. 241). He feels that such a concept is necessary to explain the fact that we normally interpret what is seen in relation to our past experience. Pathological cases are cited to demonstrate that this synthetic sense may be manifested in varying degrees of development.

Part IV consists largely of a discussion of hallucination, with some attention given to illusion and idetic imagery. The author concludes this section with a chapter wherein he discusses reports of patients suddenly acquiring vision as the result of a cataract operation. He concludes from these reports that although visual configuration is possible in the absence of visual past experience, nevertheless, a person is cognitively blind until he has had experience.

Part V is entitled, "The Human Intellect" and treats the psychology of meaning, judgment and reasoning. In discussing the former topic, Moore cites his own experiments as evidence against the identity of meaning and imagery. His experiments show that the meaning of a word arises before the images called out by that word appear in consciousness. At the end of this section there is a brief chapter on the pathology of reasoning wherein such devices as autism and rationalization are discussed.

Several chapters on the psychology of memory form Section VI. On the basis of clinical evidence the author concludes that two distinct and separate mental functions are required for any normal act of memory; (a) the storing of impressions and (b) the recall of impressions. Cases are cited to show that either one of these may be present in an individual while the other is absent.

In regard to normal forgetting, the writer suggests that retroactive inhibition can account for only a part, while "the tendency of all sensory memory traces to fade" (p. 444) is responsible for the remainder. It is suggested that rote memory differs in kind from logical or meaningful memory. Reminiscence, transfer of training, the will to learn, and the nature of the memory trace are also discussed.

The seventh and final section includes a discussion of the relation between body and mind. In this section materialism is found to be worthless, while

the Aristotelian concept of matter and form is seen to be most satisfactory. The book closes with a discussion of mental faculties.

In the final summation the author states among other things, "We venture to postulate that psychology will have to return to the concept of the soul and the living substance of which it is the vivifying principle" (p. 603).

Though the book is intended as a psychological text, it is difficult to see how it could be adapted to such use in most colleges since it covers such a very wide variety of psychological topics intermixed with metaphysics and the history of philosophy. While extremely well written, it is likely that, owing to the nature of the subject matter, most college students would find it difficult to read, though a summary is included at the end of most of the chapters and a glossary is appended at the end of the book.

FRANKLIN V. TAYLOR, PH. D.,
Princeton University.

THE CONTENT OF CELLS AND PROTEINS IN THE NORMAL CEREBROSPINAL FLUID. The Diagnostic Importance of Demonstrating Small Pathological Changes in the Cells and Proteins. The Technique of the Investigation. By *Axel V. Neel, M. D.*, pathologist to the Psychiatric Laboratory, University of Copenhagen. (Copenhagen: Ejnar Munksgaard; London: Humphrey Milford, Oxford University Press, 1939.)

Neel's investigations on the normal content of cells and proteins of the cerebrospinal fluid were started in 1914. Most of the material comes from the department for nervous and mental diseases of the Municipal Hospital of Copenhagen. In the introduction the author states that the examination of the spinal fluid is of great value in the diagnosis of all nervous and mental diseases. The most important changes from a clinical point of view are those in the content of proteins and cells. In mental diseases (psychoses, psychopathic states) an examination of the spinal fluid can give information as to whether or not there is an organic basis for the symptoms which, clinically, convey the impression of being of a purely psychogenic nature. The same may be said concerning mental disorders in children. According to Neel's experience slight changes in the cerebrospinal fluid were often found, suggesting an organic basis of the mental abnormalities which were regarded as psychogenic in nature, or believed to be caused by environmental factors. He subscribes willingly to the statement of Tilney and Riley that "no diagnosis of a disease affecting the nervous system is complete without an examination of the spinal fluid." But this necessitates that the examination is carried out as exactly as possible and by an experienced individual. When changes are found in the spinal fluid, attention must also be paid to the possibility that these abnormalities might be due to factors other than disease of the nervous system.

Two chapters deal with the cells of the spinal fluid. The systematic examination of the cells of the spinal fluid, utilizing mostly syphilitic cases, was introduced by French investigators, Widal, Sicard, Ravaut, Babinski, Nageotte. After 1903 the use of this type of examination spread to other

countries. Neel believes that the normal number of cells is given too high by most authors. As the result of his painstaking researches he comes to the conclusion that the normal spinal fluid contains not more than 1 cell per cmm. (For practical purposes 5 cells per cmm. have been fixed as the normal upper limit.) In premature children and in infants in the first weeks after birth an increase in cells and proteins has been found. In children past the very first months the same cell count is present as in adults. Experiences from children show that under abnormal conditions there may be an increase of cells without a corresponding increase of proteins.

The normal protein content and methods of determination are discussed in the two succeeding chapters. According to the author the protein content of the normal lumbar cerebrospinal fluid varies between 20 and 26 mg. per 100 cc. (Merritt and Fremont-Smith consider 45 mg. per 100 cc. as the normal upper value.) Neel refers to the changes in the spinal fluid in schizophrenia by stating that the abnormalities are more pronounced in fresh cases, whereas the changes are minimal or completely absent in old stationary patients.

The monograph is particularly valuable on account of the biography which consists of 409 well selected individual contributions, covering all the classic spinal fluid studies by American, English, French, German and Scandinavian investigators. Neel's monograph as well as Merritt's and Fremont-Smith's book *The Cerebrospinal Fluid* ought to be in the laboratory of every hospital, where spinal fluids are examined. These two volumes make available in a moment's notice every important contribution in this field.

WALTER L. BRUETSCH, M. D.,

Central State Hospital, Indianapolis.

L'EDUCATION DE DEMAIN. By J. E. Marcault and Thérèse Brosse. (Paris: Alcan, 1939.)

The word education is used in very different ways, some narrow and some broad. As the title of this book it is taken to be a term which covers the whole range of individual development. Consequently the material falls into the major divisions of physiology, psychology and social theory. The treatment is always exact and well informed, but at the same time the perspective is large: the work belongs equally to science and philosophy. Only those who expect in a work on education nothing but discussions of a curriculum or statistics of attendance will find this book disappointing.

The keynote of the exposition is integration: at the physiological level this is the integration of the organism, with its corollary of biological function. The writers make extensive use of the idea of the self, which for them is the goal of development, requiring for its complete realization a harmony of structure and function in all their mechanisms. As it is not possible to indicate all the arguments employed to support this view of conscious life, we must be content with saying that the authors clearly have adequate knowledge of the accepted facts in anatomy and neurology. But while the material structure is fully described, emphasis is laid on the influence of mind

upon body and the general tone of the work might be described as idealistic, at least to the extent that consciousness plays an active part. It may not be out of place to recall that one of the authors previously collaborated in a study of the Yoga discipline in India, as some of the results of that experience are recorded in this work (p. 104).

It will be obvious that the method here used has interesting applications for cases of dysharmony and the field of psychiatry in general. The authors maintain that there is a psychological structure distinct from the physiological, and it has its own nature and laws: the kind of work done by Spearman and Bergson in their different ways is considered nearer the truth than the doctrine of the strict Behaviorists. As the important aspect of education is the development of consciousness, the relation of the individual to his social environment is the climax and the treatment of this subject involves the most general principles, among which the concept of liberty takes the first place. In this context Adler's views on personality, the Dalton plan and the Boy Scout movement are severally discussed, a list which sufficiently indicates the wide sweep of the authors' horizon. The book as a whole offers an unusual combination of factual knowledge with a balanced philosophy of life and a progressive outlook, seeing in the future a better world for the individual and society as a result of a more enlightened type of education. It is a book to be recommended, but no one who reads it now could be unconscious of its tragic significance. The buoyant tone, the confident acceptance of the ideals of individuality and freedom, the belief in education as a spiritual adventure, all these may belong to the "education of to-morrow" but they also remind us that the authors were writing in a civilization that, for the present at least, is eclipsed.

G. S. BRETT, M. A.,
University of Toronto.

MINOR MENTAL MALADJUSTMENTS IN NORMAL PEOPLE. By J. E. Wallace Wallin. (Durham: Duke University Press, 1939.)

This book is designed for lay workers in the field of mental hygiene and for the most part is comprised of case histories. Beyond the opening chapter, in which the author discusses his purpose and explains the method by which he obtained the autobiographical material and the character of his "respondents," the book contains practically no theoretical exposition and little editorial comment. An exception is the chapter on "Fears and Phobias" in which, after a short statement on the nature of fear and 34 questions directed to the student, the author briefly reviews the hypotheses of Freud, Adler, Rivers and Morton. Most chapters contain only an introductory paragraph descriptive of the problems to which the episodes relate, followed by a half dozen "guiding questions" and a brief bibliography. A few lack even this preface, others contain no suggestive questions. It is clear from the introduction that Wallin intends this purely as a source book and expects the reader to use as a text his earlier publication *Personality Maladjustments and Mental Hygiene* (1935).

The author states that altogether he has obtained 600 case histories from 300 students, half of which is presented in this book; 200 of these histories appear in his previous work. It is obvious that many students must have turned in two or more such "histories." Since most of them deal only with a single problem or complex of symptoms, perhaps "report" would be a better term. They may give the genesis of the deviation under discussion but are hardly "case histories" in the sense in which that term is usually understood. This material is drawn from the author's graduate and undergraduate students in various Eastern universities and normal schools working in the field of psychology and education, the majority being professionally trained educators. Each was given a questionnaire entitled "An Inventory of Early Difficulties of Adjustment" together with "Suggestions as to Processes of Adjustment" to be used as a basis for recording his or her own difficulties. In addition to condensing and classifying the material submitted, the author has contributed the caption for each report. Rather long, they are intended to give a descriptive and explanatory epitome of the contents. Usually the explanations proffered are essentially those suggested by the respondents themselves but Wallin has occasionally substituted interpretations which seemed to be indicated by the context though at variance with certain statements in the reports. He has also, though comparatively rarely, indicated the mental mechanisms involved in some of the behavior patterns.

The primary purpose of the book is to make available a collection of first hand data concerning the personality maladjustments of normal people, attention hitherto, Wallin believes, having been focussed too largely on the more dramatic pathological cases. The recognition that "normality" is relative is of course implicit throughout. The types of problems presented include fears and phobias, anxiety and worry, bashfulness, feelings of inferiority, obsessions and compulsions, dreams, superstitions, attitudes conditioned by unfortunate home and school situations, food fads, etc. A consideration of sex problems as such has been purposely omitted from this volume. In his earlier book Wallin classified the reports according to the mechanisms involved but here no classification beyond the symptomatic has been attempted.

The author's judgment of the value of these reports is particularly enlightening. It is critical to the extent that he freely admits that the causal explanations offered by the respondents are sometimes incorrect. It verges upon the popular inability to realize that "unconscious material" is really beyond the reach of conscious awareness in the statement that "... many people, if not most of them, by persistent effort are able to recall a surprisingly large amount of their buried experience and the surrounding circumstances." And it is rather more than eclectic, suggesting some prejudice to analytic techniques, in "affirming that one of the merits of the book is the demonstration that the sources of many maladjustments and personality traits can be discovered by reasonably intelligent people without the use of any intricate, esoteric diagnostic procedures." The reviewer's opinion is that the case material will prove useful in furnishing abundant illustrations of such "minor maladjustments" at the symptomatic level, but relatively value-

less and often misleading in attempting to trace their etiology or to give any understanding of the real dynamics involved in their resolution.

ISABELLE KENDIG, PH. D.,
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VIRGINIA'S SOCIAL AWAKENING. By *Arthur W. James*. (Richmond, Va.: Garrett & Massie, Inc., 1939.)

The author, who was Commissioner of Public Welfare for Virginia from 1932 to 1938, traces the development and accomplishments of the State Board of Charities and Corrections of Virginia from its organization in 1908, with especial reference to the outstanding contribution of the Reverend Joseph T. Mastin, the secretary and guiding spirit of the Board from 1908 to his retirement in 1922. The book is an excellent illustration of the fact that social advances do not "just happen," but almost always reflect the genius of one man which finds more or less ready acceptance by the larger group which is inclined to let matters drift until stimulated to action.

Dr. Mastin did much to modernize the care of the dependents, delinquents (adult and juvenile), the mentally defective and the mentally ill in Virginia. Under his administration the condition of the jails, prisons and almshouses was greatly improved, a juvenile court act was passed, probation was encouraged, voluntary and emergency commitment laws were enacted, provision for the criminal insane was made, and an institution for epileptics was established. One of the most gratifying features of Mr. James' tribute is the fact that Dr. Mastin is still alive to learn from this volume, as in many other ways, the high regard in which he is held by his fellow-citizens.

To members of the American Psychiatric Association the volume is welcome as a reminder of one of our distinguished past presidents, the late Dr. William F. Drewry. Indeed, in some ways Dr. Drewry is almost a hero of the volume. He it was who organized, in 1900, the State Conference of Charities and Correction, which laid the groundwork for subsequent progressive legislation, and he it was who urged Dr. Mastin's appointment upon the first Board. An eloquent eulogy of Dr. Drewry by Dr. Mastin is quoted at length in the volume (pp. 152-154), and the author refers to him as "Virginia's most effective pen and voice in social reform and progress from 1885 until his death in 1934."

The book is a stimulating account of what has actually been done toward social progress in one of our forward-looking Commonwealths, and a warm tribute to two great spirits.

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BAUSTEINE ZUR PSYCHOANALYSE. Vols. III and IV. By *von Dr. S. Ferenczi*. (Bern: Verlag Hans Huber, 1939.)

These two volumes complete the task of gathering together all of the writings of Sandor Ferenczi (1873-1933), the distinguished collaborator of Professor Sigmund Freud. They are a labor of devotion of several of

Ferenczi's prominent pupils, especially his Budapest associates, and have been issued under the general editorship of Vilma Kovacs. With two volumes which appeared previously, all of the psychoanalytic writings of Ferenczi scattered in many journals over a period of more than thirty years, in addition to many hitherto unpublished notes, comments and fragments of papers, are now readily accessible.

The intimacy of Freud with Ferenczi was more enduring and profound than with any other of his associates. They spent several successive summer holidays together prior to the World War, and says Freud "A number of papers which appeared later under his or my name first took form there in our talks" (*International Journal of Psychoanalysis*, Vol. XIV, p. 297). The influence of Ferenczi's scintillating imagination upon Freud and upon the development of psychoanalytic theory and practice was not extensive but very intensive, for Ferenczi had a tendency to carry his ideas to extremes, a characteristic of which he himself was quite aware. The close association and informal collaboration which many think retained too much of the master-student character, continued until Ferenczi's publication of *Thalassa, A Theory of Genitality*, in 1924, after which Freud and Ferenczi began to drift apart. This notable work of Ferenczi represents an attempt to apply psychoanalytic theory to the biological sexual striving and biology in general and shows a change in accent from Ferenczi's previous extraordinary interest in metapsychology to physiology.

One need only turn to the index of the first volume of the *Zentralblatt für Psychoanalyse*, the first psychoanalytic periodical published, to appreciate the fecundity of Ferenczi's imaginative thinking and the range of his intellectual interests. In this one volume we find contributions to such a variety of topics as manic-depressive insanity, ejaculatio precox, psychoneuroses, concerning obscene words, Anatole France as an analyst, the psychological analysis of dreams, and an observation on irritation of the anal zone as a cause of paranoia which supplemented some of the mechanisms elaborated by himself and Freud in the analysis of paranoia.

Ferenczi's profusion not only in quantity but in diversity is likewise apparent in Volumes III and IV. Volume III consists of articles of the prolific years from 1908-1933, and the subject matter covers the range of psychoanalysis in all its applications—clinical observations, case reports, philosophy, essays on criminology, mental hygiene, war neuroses, analyses of organic conditions such as the psychoanalysis of parietic mental disturbances, technique.

From 1927 onward Ferenczi's preoccupation with the technique of therapy became more and more evident. A certain disappointment in the therapeutic application of psychoanalysis, perhaps shared by Freud, led to three papers; in 1927 "The Problem of Termination of Analysis" (read before the Tenth International Psychoanalytic Congress in Innsbruck); in 1928 "Elasticity in Psychoanalytic Technique"; and finally "Child Analysis with Adults" in 1931. Undoubtedly the reason for his interest in modification of the strictly passive technique is found in his acknowledgment of the small number of

psychoanalyzed cases that had been carried by him to a natural end. To quote (Vol. III, p. 279), "if you ask me whether I can point to many complete analyses, then I must answer no. I am firmly convinced that if one has learned enough from his deviations and mistakes, if he has gradually learned to take care of the weak points of his own personality that the number of cases analyzed to the end will increase."

In all of his writings on technique there is a solid, self-critical honesty which stands out in sharp contrast to the unbridled imagination manifest in some of his theoretical flights. Evidently the not wholly satisfactory results which Ferenczi had obtained weighed heavily upon him in his later years and led to an increasing leniency and indulgence of his patients.

In Vol. IV are collected Ferenczi's reviews of books and articles mostly written in his earlier years, and over one hundred pages of fragments on a variety of subjects. Some of these fragments are little more than marginal notes. Others, however, reach the length of short articles, any one of which is bound to cause reflection by any worker writing on that particular or a kindred subject. At the end of Vol. IV there is a complete bibliography of Ferenczi's published works and an unusually well arranged index to the monumental contributions of this ingenious, tireless, genial, gentle and distinguished member of the original psychoanalytic group.

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THE MENTAL HYGIENE MOVEMENT: FROM THE PHILANTHROPIC STAND-
POINT. (New York: Central Hanover Bank and Trust Company, 1939.)

This attractive brochure has been prepared by the Department of Philanthropic Information of the Central Hanover Bank and Trust Company, as the third in "a series dealing with various important fields of philanthropy in which funds may wisely be spent." Those responsible for this work are to be warmly congratulated as they have succeeded in turning out a very real contribution. In unusually small compass, but without any sense of crowding, and in remarkably clear readable style, a surprisingly complete and vivid picture is presented of the mental hygiene situation, from introductory explanations and definitions through history and growth of the movement and discussion of the proportions of mental illness, to present urgent needs. The authors have succeeded notably in their purpose, in a quick and telling way, of introducing a most important field for philanthropic investment to possible donors. In addition, as an excellent general summary and analysis, this little volume should be very helpful to laymen and professionals alike, and is strongly recommended.

T. R.

FEEL LIKE THIRTY AT FIFTY: RENEWED VIGOR THROUGH GLAND HYGIENE.
By Edwin W. Hirsch, B. S., M. D. (Chicago: Research Publications,
1939.)

The catchy and rather misleading title of this small volume is obviously meant to attract the attention of middle-aged lay readers. The author's

purpose in writing the book, as he states, is "to show that prostatic disorder of middle and later life is largely preventable."

Briefly stated, Dr. Hirsch's theory is that the retention of secretion which produces prostatic enlargement is attributable to inhibition or prolonged non-appeasing of normal sexual excitement. From this view prostatism, occurring to more or less degree in forty per cent of men over the age of fifty, finds its place among the growing number of organic disorders whose earliest cause lies in unbalanced life attitudes and habits.

In his therapeutic approach the author stresses the use of reassurance and reeducation in addition to the proper correction of organic aspects. It is rather surprising to find that the discussion of such subjects as premature ejaculation, frigidity and impotence does not include mention of more special psychotherapeutic procedures which are often required for both partners.

Despite the over-simplifications and broad generalizations which are to some extent inevitable in a book written for the average layman, the psychiatrist can heartily endorse Dr. Hirsch's vigorous exposition of the need for biologically sound sex practice, and will find this book suitable for the occasional middle-aged patient requiring practical orientation with respect to the commonly misunderstood subject of prostatism.

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CURRENT PSYCHOLOGIES: A CRITICAL SYNTHESIS. By *Albert J. Levine*,
Ph. D. (Cambridge, Mass.: Sci-Art Publishers, 1940.)

The author discusses at some length the "Neurological School," "Gestalt Psychology," the "Purposivist School of Psychology" (essentially McDougall), the "Freudians" and the "Freudian Dissentients" (Jung, Adler, Rank). A few pages on "Relationships in Mental Disorders" are thrown in. The author's intention to be fair with all these schools is obvious; he gives a summarizing appraisal of their contributions and takes pains and shows skill in pointing out similarities and differences. Yet, leaving the book, one is not satisfied and has the impression that it was written rather hurriedly. In its present shape this reviewer feels unable to recommend it.

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A STUDY OF JEALOUSY AS DIFFERENTIATED FROM ENVY. By *T. M. Ankles*,
A. P. D. P. (London). (Boston: Bruce Humphries, Inc., 1939.)

In this brief study Dr. Ankles attempts to analyze the problem of jealousy and at the same time to differentiate it from envy. It is an essay presented to the University of London as part of an examination for an academic post-graduate diploma in psychology.

It has been rather difficult for this reviewer to follow some of his arguments and particularly to understand at all times the use he makes of the concepts "masochism" and "sadism," although these two terms occur very frequently in his discussions. It was also rather difficult at times to under-

stand just what he intends to imply by the statement "localization of jealousy."

In his study he endeavors to investigate the problem of jealousy in fifty individuals—thirty by personal interview and ten by questionnaire. Ten were eliminated for one reason or another. The case reports are rather brief and not always very revealing. Many of his statements are dogmatic without citation of adequate supporting evidence.

Toward the end of his essay he discusses briefly the attitude of various other investigators regarding this problem and finally, in summary, makes certain suggestions regarding the methods of eradicating jealousy.

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FACTS AND THEORIES OF PSYCHOANALYSIS. Second Edition. By *Ives Hendrick, M. D.* (New York: Alfred A. Knopf, 1939.)

This is the second edition of a very practical and carefully prepared book on the subject of psychoanalysis. The material is arranged under four headings.

The facts of psychoanalysis are presented in a brief and concise form, probably more readily understood by those familiar with the literature of psychoanalysis but certainly stimulating to all intelligent readers.

The theories of psychoanalysis are set forth in a most attractive and readable form. This part of the book may well be recommended as part of an introductory reading course to students in psychiatry. The student would then be able to comprehend the classical sources of this information.

The therapy by psychoanalysis is dealt with in a way that would enable anyone to understand what is supposed to take place in a psychoanalysis. The factors to be considered as to the applicability of the procedure and suitability of the subject are clearly presented.

The fourth and last heading, "The Psychoanalytic Movement," is concerned with the historical aspects of psychoanalysis and its present status. The relation of psychoanalysis to other disciplines is discussed, stressing its cultural as well as its practical applications. The present organizations for teaching and research are described. The suggestions for further reading are helpful. This is a worthwhile book and can be recommended to all students in psychiatry.

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CRYSTALLINE ENZYMES. By *J. H. Northrop.* (New York: Columbia University Press, 1939.)

This is essentially a review of the splendid work performed in the author's laboratory on the crystallisation of pepsin, pepsinogen, trypsin, chymotrypsinogen and chymo-trypsin and on the purification of bacteriophage.

Apart from an excellent introductory chapter on the General Chemistry of Enzymes the book is concerned chiefly, though not entirely, with the practical aspects of the preparation and behaviour of the crystalline enzymes mentioned. There is a chapter on the purification of bacteriophage with an interesting discussion on the analogy between the production of phage in bacterial cultures, the production of proteolytic enzymes in solutions of their precursors, and the growth of organisms.

The title is somewhat misleading although the subtitle clearly indicates that the author does not extend his discussion of crystalline enzymes beyond the field of his own experiments. No review of work on other crystalline enzymes is attempted and indeed, with the exception of carboxypeptidase, they are merely mentioned by name.

It may be described as a very valuable compilation of the papers of the author and his collaborators.

The book should prove particularly useful for those who wish to repeat the author's preparations or to attempt the crystallisation of other enzymes, for it is full of useful suggestions from an experienced worker in this field, and there is an appendix which gives condensed descriptions of methods which have been found effective.

HARDOLPH WASTENEYS, PH. D.,
University of Toronto.

THE INVASION FROM MARS. By *Hadley Cantril* with the assistance of *Hazel Gaudet* and *Herta Herzog*. (Princeton: Princeton University Press, 1940.)

The *Edinburgh New Philosophical Journal* for 1826 contained a serious article from the pen of Dr. Thos. Dick of Dundee, described as a "piously speculative writer upon astronomy," wherein it was proposed, by the erection of huge geometrical figures of stone upon the plains of Siberia, to attempt communication with the inhabitants of the moon. This was the same Dr. Dick who gave it as his considered opinion that the obliquity of the earth's axis to the plane of the ecliptic had been caused by the sin of Adam and Eve.

In 1835 Mr. Richard Adams Locke, sprightly writer for the *New York Sun*, then newly established and seeking to increase its circulation, stumbled upon this extraordinary article in the *Edinburgh* publication. He observed also that the views of Dr. Thos. Dick of Dundee were receiving serious consideration not only by the public but by eminent astronomers and other men of science on both sides of the Atlantic.

Straightway Mr. Locke conceived an idea which should both serve the interests of his paper and have, perchance, a salutary after-effect. He would perpetrate a hoax so tremendous as to transgress the ludicrous, and which in its later explosion would have a sobering influence upon human credulity.

Thus arose the "Moon Story" which ran serially in the *Sun* during September 1835. Under the caption "Great Astronomical Discoveries lately made by Sir John Herschel, LL. D., F. R. S., etc. at the Cape of Good Hope," the writer, purporting to present extracts from the *Edinburgh Journal of Science*,

told of a marvellous new telescope with a seven-ton lens invented by Herschel with which he expected to be able ultimately "to study even the entomology of the moon, in case she contained insects upon her surface." In orderly detail the flora and fauna of our satellite were described, the climax being the account of the "Vespertilio-homo, or man-bat." These were hairy bipeds of human form, having wings which extended from the shoulders to the calves of the legs, "doubtless innocent and happy creatures, notwithstanding some of their amusements would but ill comport with our own terrestrial notions of decorum."

The Moon Hoax spread over Europe and America like a prairie fire, and while there were early notes of skepticism, "the almost universal impression and expression of the multitude was that of confident wonder and insatiable credence." The author of this statement, who in 1852 published a full account of this epidemic delusion, adds a final touch. It is seriously reported, he states, "that in many of the interior parts of Germany, and of the Continent generally, they [the lunar discoveries] remain uncontradicted to the present day, and are believed, like sacred and delightful truths, by vast numbers of the population."

This magnificent hoax of 1835 was brought vividly to mind when, a hundred years later, we read of the effect upon masses of the people of another astronomical romance, namely the Mercury Theatre on the Air adaptation of H. G. Wells' *War of the Worlds*, as broadcast by Orson Welles October 30, 1938.

On this Sunday night a million American radio listeners from Maine to California went into panic.

Here was a demonstration of the power and potential dangers of radio as well as a unique exhibition of mass psychology. The year before a radio research project had been organized at Princeton University through a grant by the Rockefeller Foundation to study the rôle of the radio for various classes of listeners. The *War of the Worlds* broadcast provided an extraordinary 'experimental' situation and an opportunity quite without parallel to study the pathogenesis and effects of panic. A special grant was made by the General Education Board to the Princeton Office of Radio Research to conduct this study. The result was the present book, the author of which is an associate director of the research project and associate professor of psychology at Princeton University.

The panic was a nation-wide phenomenon, but the effects were not equally severe in all parts of the country. Of the listeners in intellectual New England, according to the American Institute of Public Opinion, only 40 per cent were frightened by the broadcast; in other sections the number ranged around 70 per cent; but in the South it reached 80 per cent. There was a tremendous lot of praying throughout America that night.

The book presents first a complete transcript of the broadcast which gives evidence of the dramatic skill and sheer realism of the performance. There follow samples of verbatim reports of their experiences by frightened listeners in various parts of the nation. These 'clinical' data are valuable as first-hand expressions of the types of personal reactions. Classifying the

attitudes of listeners the authors found "that over one-third of the people who first turned to the broadcast as news and were not informed of their error by some other person or by some accident failed to make any checks whatsoever." About one-fifth of the listeners discovered the nature of the program by analyzing its intrinsic features. Of those who attempted to check the authenticity by external reference, a fair number succeeded but the majority did not.

Obviously differences in "critical ability" determined the various reactions observed. Some correlation was found between educational level and critical ability. "Two-thirds of those who made successful checks were high school graduates while only one-half of the people who failed to check or who checked unsuccessfully completed high school." As would be expected the study of personality traits proved fruitful in elucidating individual differences in susceptibility to panic. Traits which tended toward heightened susceptibility were: a sense of insecurity of whatever kind, phobias, memories of fright, tendency to worry, lack of self-confidence, fatalistic attitudes, superstitious religiosity.

External conditions were also duly evaluated. There were many and varied individual differences in the "listening situation" which might play even a major rôle in the reaction. The troubled state of the world was also reckoned in for its share of responsibility. "Critical ability alone is not a sure preventive of panic. It may be overpowered either by an individual's own susceptible personality or by emotions generated in him by an unusual listening situation." The author's further pronouncement makes the outlook rather discouraging for most of us. "If critical ability is to be consistently exercised, it must be possessed by a person who is invulnerable in a crisis situation and who is impervious to extraneous circumstances."

Hoaxes and panics have occurred before, but none like this one, and fortunately the machinery was available for an immediate scientific study on the ground, the findings of which are recorded in this book. It has value for its psychological, sociological and psychopathological data on human nature and human reactions.

C. B. F.

In Memoriam.

WILHELM STEKEL.

1868-1940.

Dr. Wilhelm Stekel, one of the pioneer associates of Sigmund Freud, was found dead in his hotel room in London, June 25, 1940. In a recent letter from his wife we received the sad news that his end was expedited by his failing health and apprehension over war conditions in Europe. His invalidism due to complications from a diabetic and bladder condition, made it no longer possible for him to continue his work, depriving him at the same time, of his many personal pleasures such as walking, reading and practicing his music.

Because of his open anti-Nazi views he was compelled to leave Vienna at the time of the Anschluss in 1938. Like many others confronted with the same tragic predicament, he found refuge in London. The European situation undoubtedly had a very depressing effect on him. In addition to being unable to establish any communication with his son, daughter and son-in-law, stranded somewhere in France, or his step-daughter in German-occupied Norway, he lived under constant tension facing blackouts and the danger of another Hitler invasion.

At the time of his death he was surrounded by open books and had written a public letter to England in which he said:

I am passing away like a warrior. Guns and cannon are only temporary. The greatness for which England stands will put right all wrongs.

He was apparently in good health up to 1937, and during the summer of that year, as his last pupil from the United States, I had the privilege of sharing many happy hours of tennis with Dr. and Mrs. Stekel. He loved life, never suspecting he would some day suffer physical and mental agonies, for in a foreword to the author's book *Why Grow Old?* he wrote in part as follows:

I am nearly seventy and have not felt, as yet, the burden of my years. I am still clinging to those elements in life which keep one perpetually young:

enthusiasm for living, recreational sports, cultural interests, love and creation. In this struggle for vitality, one should never surrender ideals for fear of the approaching years. There is one and only one true means of rejuvenation: keeping your heart everlastingly young; being able to spiritually burn for ideals, for all that is beautiful in this world, and for all that can thrill you emotionally.

Dr. Stekel was born in 1868 in Bojan, Bukovina, Rumania, the youngest of three children. He had a great adoration for his mother who made endless sacrifices in order that he might receive his education. In token of appreciation he dedicated to her memory his very popular book *A Primer for Mothers* which was widely circulated and translated into many foreign languages. It is said that as a child, his parents became so angry with him because of his boredom with studies that they took him away from school and made him an apprentice to a shoemaker. This measure proved psychologically effective for he returned to high school and became a very brilliant student. He earned part of his way through the University of Vienna Medical School, by giving lessons. He had two children by his first wife. His daughter Gertrude, a painter, married the son of a world famous anatomist, Zuckerkandl, while his son Erich who inherited his father's great love for music, became an accomplished musician. His wife who survives him no doubt played a great part as the inspiration behind his many achievements.

Dr. Emil Gutheil, author of the *Language of the Dream*, who is Dr. Stekel's most outstanding pupil in this country, having known him for approximately 20 years, was kind enough to lend his generous collaboration in the presentation of the following biographical material.

About 40 years ago Dr. Stekel wrote a pamphlet dealing with the subject of sex impulses in childhood. Freud expressed a keen interest in the essence of this early contribution and as a result Stekel finally became Freud's assistant. According to a statement in *Fortschritte der Sexualwissenschaft und Psychoanalyse* edited by Missriegler and Gutheil, *Zur Geschichte der analytischen Bewegung* he began using the psychoanalytic technique in 1903. His first cases were referred to him by Freud to whom he presented them for consultation every two weeks. This was the usual "control analysis" common to those days.

He was a founder of the first psychoanalytical society and editor of the *Zentralblatt*, the first psychoanalytical periodical which he conducted with Freud and Adler. In 1912 however, like Adler and Jung, he broke away

from Freud. One of the first scientific discoveries which foreboded his secession from Freud was that every neurosis is based upon a mental conflict. At that time, Freud believed in the organic nature of some nervous diseases such as anxiety neurosis. Stekel later formed an "Association of Active Medical Analysts" and a clinic where patients were treated and courses and seminars for physicians were held. This group was characterized by their strict stand against lay analysis.

In the course of time Stekel introduced a new technique which he called "active psychoanalysis" based on a special technique of interpreting the analytical material and requiring from the physician greater activity in handling the analysis. Many of his pupils are now using his method in various parts of the world.

His life's work was *Disorders of Instinct and Affect (Stoerungen d. Trieb-u. Affektlebens)* in 10 volumes, 1908-1928, a peerless collection of ingenious observations and excellent case histories. New schools of thought replace old ones; theories and hypotheses change. But just as Semmelweis' observations in the delivery room, and Koch's microscopic findings remain the inalienable property of science, so will Stekel's treasury of clinical observations and casuistic material survive the challenge of future scientific theories.

Among his other writings are: *The Depths of the Soul*, 1921; *Sex and Dreams*, 1922; *Homosexual Neurosis*, 1922; *Bi-Sexual Love*, 1922; *Frigidity in Women*, 1926; *Impotence in the Male*, 1927; *Sadism and Masochism*; *Marriage at the Crossroads*, 1931; *Technique of Analytical Psychotherapy*, 1940. Just prior to his death, he completed his autobiography which will be submitted for publication in the near future.

Suffering mankind has lost a great healer. He was a man of much wisdom, a born philosopher, a learned journalist, a world famous psychotherapist and a great teacher.

In tribute to his memory may these words of Thomas Campbell's *Hallowed Ground*, bring comfort to his pupils and those who knew him: "To live in hearts we leave behind, is not to die."

FRANK S. CAPRIO, M. D.

SIDNEY DEAN WILGUS.

1872-1940.

Dr. Sidney Dean Wilgus died at his home in Rockford, Ill., on February 23, 1940, at the age of 68 years.

He was born and educated in Buffalo, N. Y., graduating from the University of Buffalo School of Medicine in 1895. At this time Dr. Wilgus was appointed to the New York State Hospital Service where he served as psychiatrist, New York State Hospitals, until 1902; psychiatrist, New York City Municipal Hospitals,

1902-04; and chief examiner, New York State Board of Alienists, 1904-10. From 1910-11 he was superintendent of the Elgin (Ill.) State Hospital; and from 1911-13 superintendent of the Kankakee State Hospital.

Dr. Wilgus founded the Wilgus Sanitarium at Rockford, Ill., in 1913, and was director of this institution until his death. During these years he took a great interest in mental hygiene and social welfare and served as alienist on the Board of Public Welfare, State of Illinois (1929-33), and as a member of the Rockford Hospital staff since 1915. Dr. Wilgus was also appointed professor and head of the department of psychiatry at the Chicago Medical School in 1936. He was past president of the Chicago Neurological Society, a fellow of The American Psychiatric Association, a member of the Central Neuropsychiatric Association and a fellow of the American College of Physicians. He served in the ranks in the Spanish-American War, and as a consultant, hospital inspector and a member of the Medical Appeal Board during the World War. He held a commission of Lieutenant-Colonel in the Medical Reserve and was president of the Reserve Officers' Association of Illinois 1925-26.

Dr. Wilgus' main professional ability and interest was in the field of organization and administration, although he contributed frequently to the literature on clinical psychiatry. He surveyed the conditions surrounding the care of the mentally ill and feeble-minded in four states for the National Committee for Mental Hygiene. He did much work in child psychiatry and was in demand as a medico-legal expert. His ideas were conservative, he was a clear thinker and a forceful speaker. He was a genial gentleman and loved companionship. He took an active part in the professional, business and social affairs of his city. He had been afflicted with a heart ailment for two years but was not incapacitated by it, continuing his work at the sanitarium until the day of his death.

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